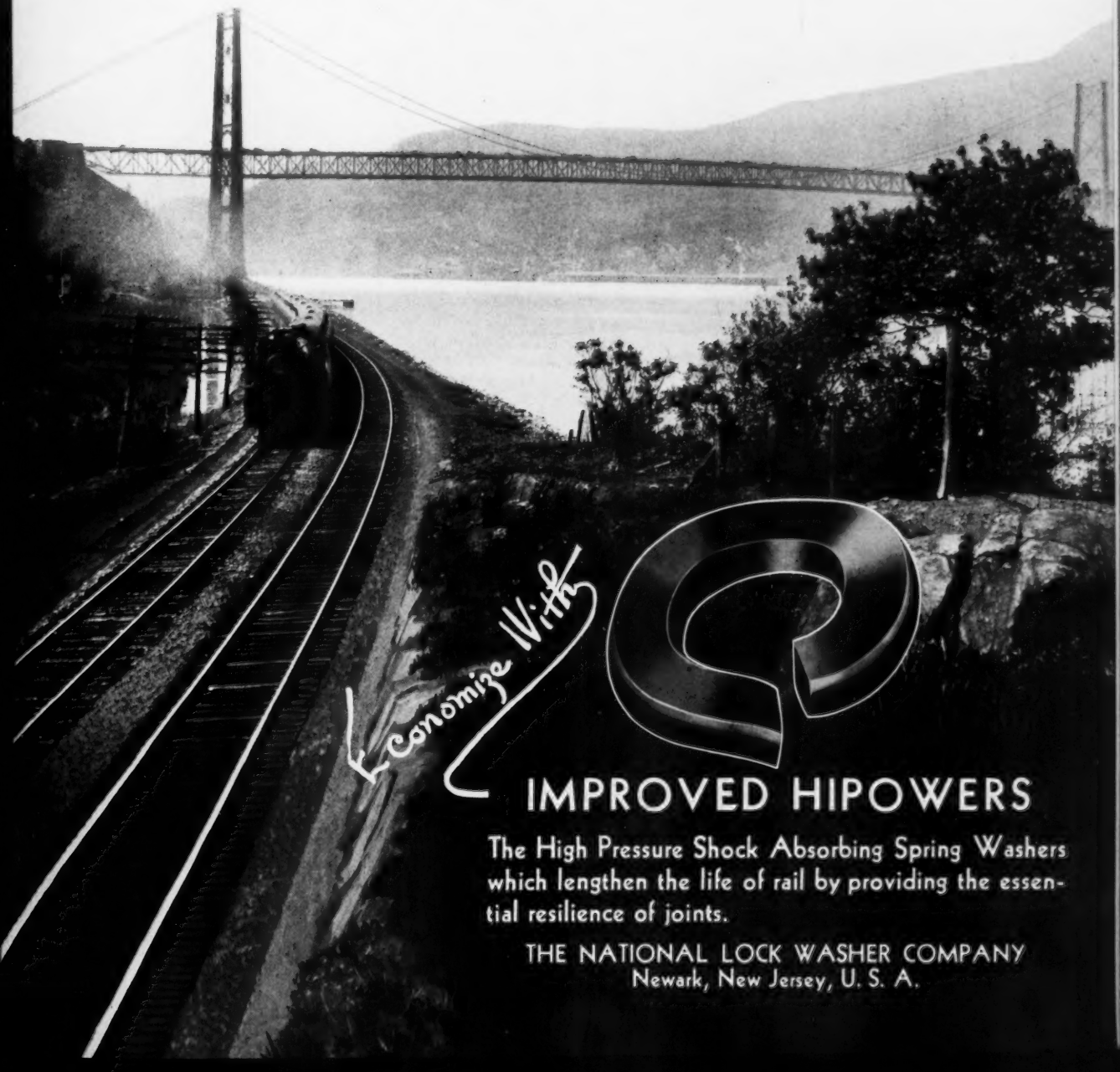
August, 1931

Railway Engineering and Maintenance


Economize With
IMPROVED HIPOWERS
The High Pressure Shock Absorbing Spring Washers which lengthen the life of rail by providing the essential resilience of joints.
THE NATIONAL LOCK WASHER COMPANY
Newark, New Jersey, U. S. A.

Smooth riding track is easier

obtained with the use of . . .

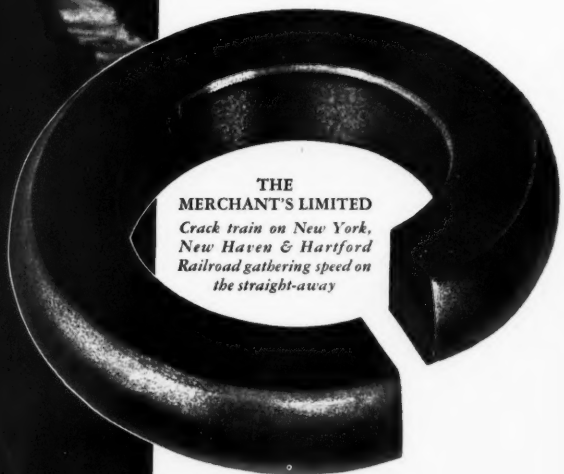
HY-CROME

As the wheels pass over the rails, mile after mile, passengers enjoying the ride from the rear end platform notice the smooth riding qualities of HY-CROME equipped track.

Wheel impact and axle loads have less wearing effect on joint parts when bolts are equipped with HY-CROME spring washers. Non-fatiguing, they maintain sufficient tension in the bolted parts and automatically compensate for wear.

The experience of other railroads guarantees satisfaction.

THE
RELIANCE MANUFACTURING CO.
MASSILLON, OHIO
Engineering Materials, Ltd., McGill Bldg.
Montreal, Quebec, Canada



HY-CROME
Reg. U. S. Pat. Office

RAILWAY ENGINEERING AND MAINTENANCE
Published monthly by Simmons-Boardman Publishing Co., at 2200 Port Washington Road, Milwaukee, Wisconsin. Subscription price: United States, Canada and Mexico, $2.00; foreign countries, $3.00 a year. Single copy, 35 cents. Entered as second class matter February 14, 1931, at the postoffice at Milwaukee, Wisconsin, under the Act of March 3, 1879.

Alphabetical Index to Advertisers, Page 762 Classified Index to Advertisers, 758-760

Using Treated Cross Ties *is not enough*

For Utmost Economy They Must Be *Plated Properly*

ALL the care and money spent for preservative treatment is lost if tie plates are used which cut into the treated layer of the timber.

You DO get proper protection from Lundie Tie Plates. Millions in service prove it. There are no sharp projections—instead the bottom has a series of rounded steps which hold track to gauge without cutting a single fibre of the tie.

Lundie Tie Plates guard against tie depreciation. Their use effects big economies, longer tie life and fewer renewals. They assure full return from treated cross ties.

The Lundie Engineering Corporation

285 Madison Avenue, New York
59 East Van Buren Street, Chicago

LUNDIE TIE PLATE

Whole Deck One Big Tool Tray

Deducting only the small 24½x43" engine enclosure, the whole length and width of the car body (with 16" wheels) is all in ONE tray 75" long, 60½" wide: net 24½ square feet.

Timken Belt Control Pulley

The Endless Cord Belt is tightened or loosened to start or stop the car, by a control pulley running on two Timken bearings.

Twelve Timken Bearings in Car

There are eight Timkens in the four axle boxes, two in the belt control pulley, and two on the engine crankshaft.

New, Simple Engine—Type L

6 to 11 H. P. Cylinder, crankcase and water jacket cast in one unit, reducing number of parts and joints. Guaranteed not to burst by freezing: automatic overflow prevents filling jacket too full. Easy access to ports for clearing out carbon: six nuts release cylinder head. Long starting crank safely supported.

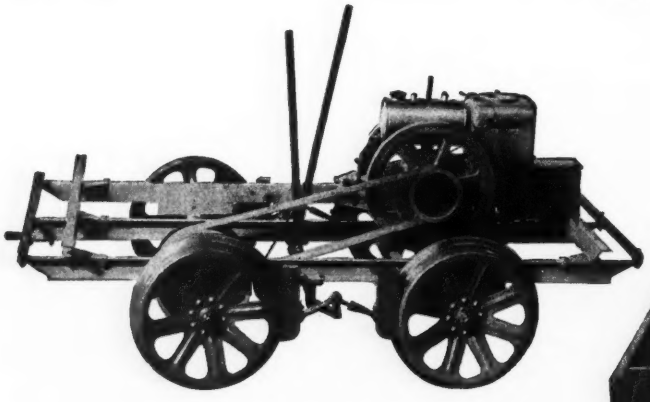
A STRANGER TO ITS PRICE CLASS

Fairmont Endless Cord Belt Drive

Time-tested and most economical transmission: has no lacing, hence unbreakable in service. Twice as strong as ordinary belt: four times as strong as a laced joint: fourteen times stronger than average tension when running.

taper bored to fit and revolve with standard axle, protecting it from wear. Prevents "sticking" due to obsolete taper bearing.

Extra quality, full ¼" carbon steel plate *Cold Formed* Wheels. Each of eight ½" rivets squeezed tight by 40-ton pressure, while red hot. Square shoulder, *Certified* malleable hub.



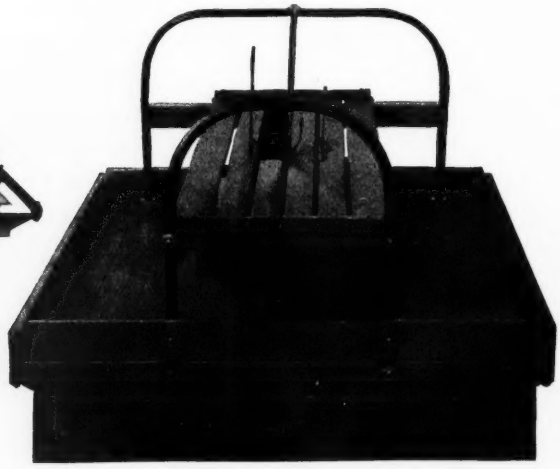
Structural Steel Frame

Seven channels of 3" 4.1 lb. section, held by ½" cut thread bolts, lock and bevel washers. Alignment maintained by the nine gusset plates.

Entire deck, seat and safety railings lift off as one single unit when four bolts removed, throttle and choke disconnected. Leaves engine on chassis ready to run.

Non-Sticking, Bronze Bushed Loose Wheel

Makes car turn easily and quickly in setting on or off track. One front wheel rolls freely on outside of straight-fit, well lubricated bronze sleeve which is



Easily Reversed

Saves turning car on track to run back to good set-off.

Simplicity

No valves in explosion chamber: no rocker arms, push rods, tappets, camshaft or gears to maintain.

Extra Wide Tool Tray Extends Clear Out Above 16" Wheels (Which Are Furnished Optional).

THE RAILROAD WORLD

THE FAIRMONT 52

STANDARD SECTION CAR—SEATS 9 MEN

Before you buy any standard section car at any price, inspect the Fairmont 52. Just a few minutes casual comparison proves that the 52 has no business being in its price class. It's a far, far, better car.

Do you want rugged service? Here's a bolted seven-membered steel chassis with a decay-resisting white oak demountable body. The foot boards are so strong they can carry rails in emergency.

Want power and service-capacity? The 52 seats 9 men comfortably, 10 if necessary. Carries a two-ton load safely. Draws three trailers and sixty men on level track. Tool-capacity? Unexcelled! The extra-wide tool trays extend clear out above the 16" wheels. Do you want speed? The new type L engine gives you an even flow up to 25 miles per hour.

And as for *dependability*—this is a Fairmont car, with all of those extra features and refinements—too many in number and too well known to mention—which have meant *Lowest Over-all Cost* in railroad service. Let us send you the complete specifications on the 52 or any member of our complete line.

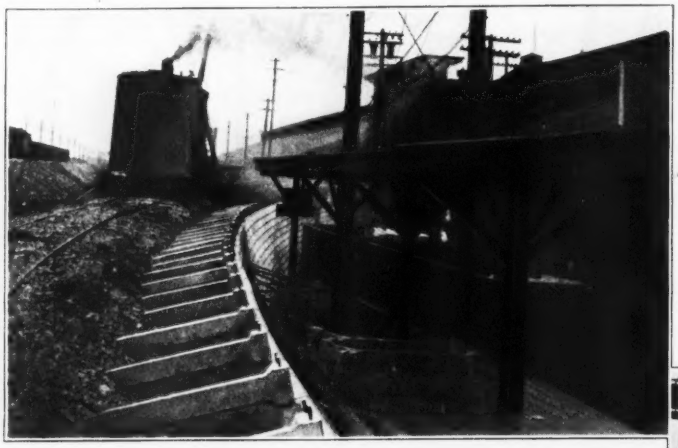
FAIRMONT RAILWAY MOTORS, INC.
FAIRMONT, MINNESOTA, U. S. A.
General Sales Offices: 1356 Railway Exchange Building, CHICAGO
District Sales Offices:
New York City Washington, D. C. St. Louis San Francisco
FAIRMONT RAILWAY MOTORS, Ltd., Toronto, Canada
Foreign Representative: THE BALDWIN LOCOMOTIVE WORKS

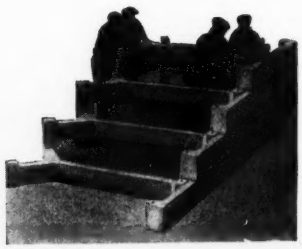
Manufacturers of section motor cars, inspection motor cars, gang and power cars, weed burners, mowers, ballast discers, ball and roller bearing engines, push cars and trailers, roller axle bearings, wheels, axles and safety appliances

Fairmont Mudge
Performance on the Job Counts

REMEMBER . . . OVER HALF THE RAILWAY MOTOR CARS NOW IN SERVICE ARE FAIRMONT PRODUCTS

KNOWS FAIRMONT





At the right, a view along the new L&N wall at Birmingham, Ala. showing the attractive closed face; above a portion of the wall before completion of backfill. Note the graceful curve.

The

L&N

Selects

FEDERAL RETAINING WALL

for

Birmingham Grade Separation

Because modern 2-piece cribbing construction is *more economical* than a poured wall (25 to 40% less, according to the American Railway Bridge and Bldg. Ass'n. findings)—and saves money as well over other cribbing constructions, railroads are selecting Federal for more and more of their retaining wall projects.

Not only do they obtain the required strength, stability, and permanence at this lower cost, but a closed-face wall of fine masonry-like appearance—100% salvage value for re-location—*and no maintenance!*

If you haven't *all* the facts on Federal, send for booklet "The 2-Piece Retaining Wall"—no obligation whatever.

FEDERAL-AMERICAN CEMENT TILE CO.

Executive Offices: 608 South Dearborn Street . . . . CHICAGO

Plants Near CHICAGO NEW YORK PITTSBURGH BIRMINGHAM

Concrete Products *for Over 25 Years*

FEDERAL 2 piece Concrete CRIBBING

THESE FEATURES are worth more!

The Patented Crawler Base that gives positive traction even while turning.

* * *

The "feather-touch" clutch control.

* * *

The helical gear drive.

* * *

Slow speed power plants on spring mountings.

* * *

Ball or roller bearings on all high speed shafts.

* * *

A forged steel center pin that takes the strains off the travel shaft.

No other shovel, crane or dragline offers the railroad man as many money-making, time-saving advantages as the Northwest.

To equal a Northwest every other manufacturer would have to add the "feather-touch" control, the helical gear drive, a steering device that assures positive traction on both crawlers even while turning, a *forged steel* center pin, a *slow speed,* heavy duty power plant, and many other valuable features.

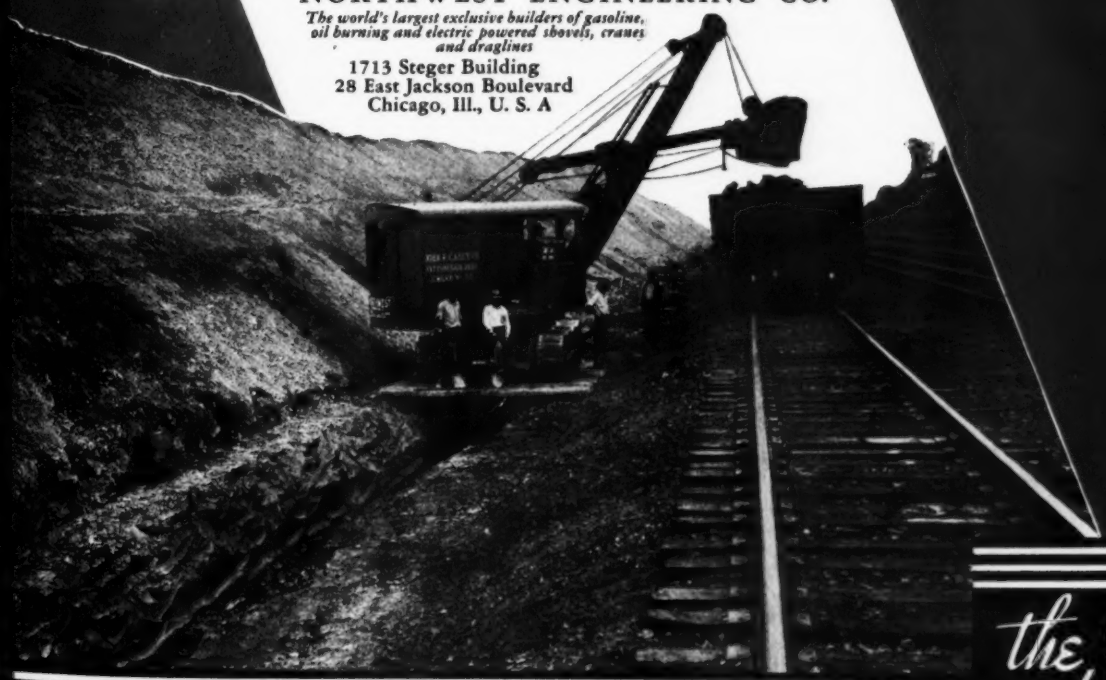
These features are worth more! They are the reasons why 42% of the crawler machines on American Railways are Northwests.

Ask what they mean to you!

NORTHWEST ENGINEERING CO.

The world's largest exclusive builders of gasoline, oil burning and electric powered shovels, cranes and draglines

1713 Steger Building
28 East Jackson Boulevard
Chicago, Ill., U. S. A

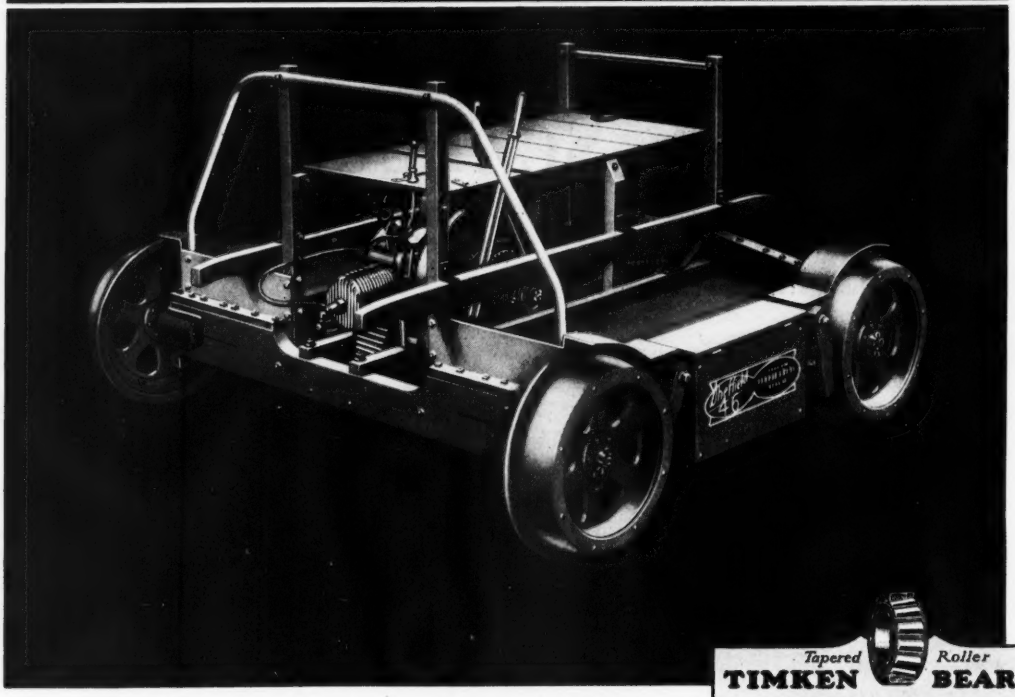


NORTHWEST

DEM & Gray

the STANDARD *by which* SHOVELS AND CRANES *are* MEASURED

FIRST ON THE RAILS—AND STILL FIRST



Tapered Roller TIMKEN BEARING EQUIPPED

The new Sheffield No. 46 weighs less than 400 pounds. Lifting weight only 100 pounds!

"Sheffield"

The greatest value in railway motor cars

Sheffield Motor Cars are the *lowest overall* cost cars on the market. Therefore they cannot always be the lowest *priced.*

They are built with every economy known to modern production methods in America's most completely equipped railway motor car manufacturing plant. Economies of this sort include none which impair efficiency and dependability.

If a car the equal of Sheffield is ever produced—the Sheffield will be lower priced. Sheffield purchasers are assured of the greatest dollar-for-dollar value in railway motor cars. Ask us to prove these claims.

Sheffield Motor Cars

The complete Sheffield line includes the following models. Write for complete information about any or all of these *lowest overall cost* cars.

Sheffield No.	32	—Section Car
" "	33	—Section Car
" "	36	—Signal and Maintainer's Car
" "	40B	—Heavy Section, B. & B. Extra Gang Car
" "	41	—Roadmaster's, Supervisor's and Signalman's Car
" "	44B	—Section and B. & B. Car
" "	45	—Section Car
" "	46	—All Light Service Car
" "	700	—Series Section Cars

FAIRBANKS, MORSE & CO., Chicago

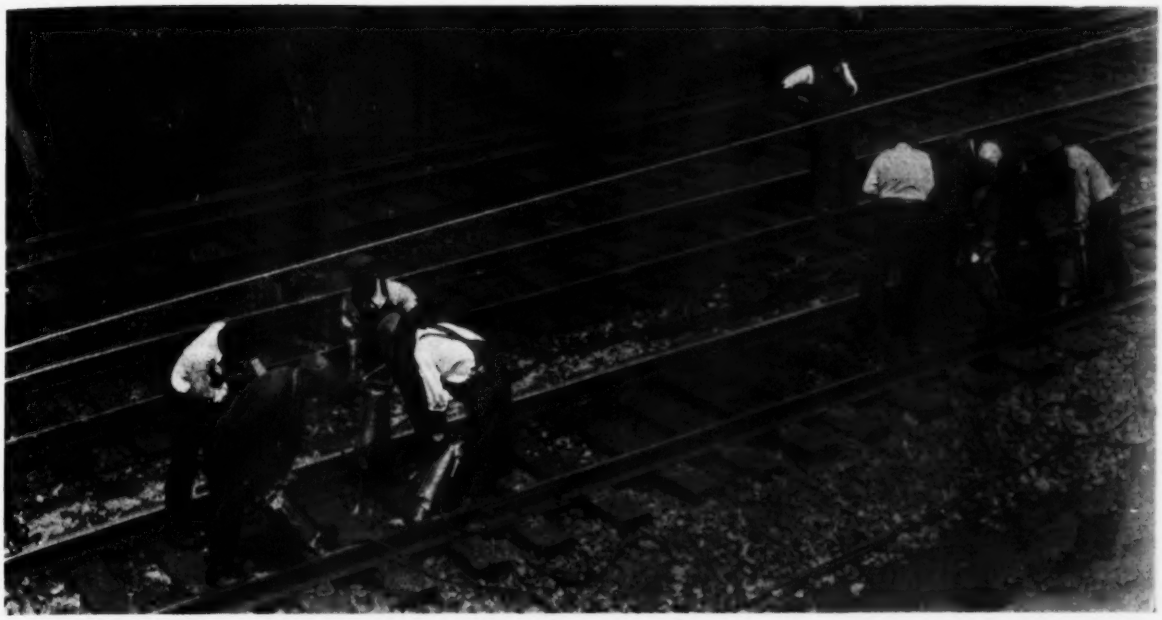
Manufacturers of railway motor cars; hand cars; push cars; velocipedes; stand pipes for water and oil; tank fixtures; stationary and marine oil engines; steam, power and centrifugal pumps; scales; motors and generators; complete coaling stations.

FAIRBANKS-MORSE

Motor *Cars*

First on the rails—and still first

5549-RA21.80



SYNTRON

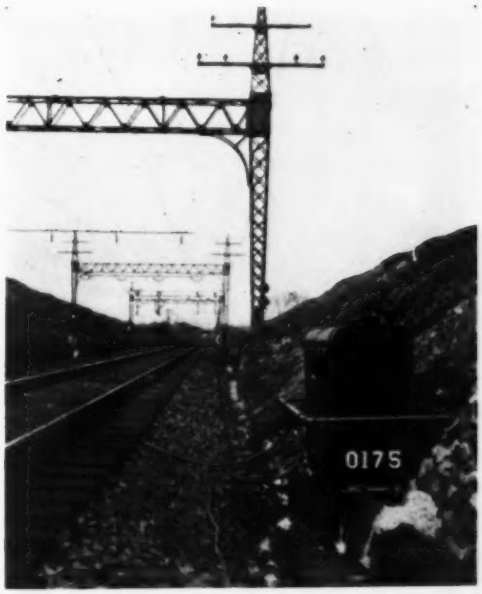
ELECTRIC TIE TAMPERS

Are Electro-Magnet Hammers and Have

Only One Moving Part

Operating from Small Gas-Engine Driven Electric Generating Plants Their Use is the *Economical* Way to Produce

UNIFORMLY TAMPED TRACK



Built in 2-4-6-8-12-16 Tool Outfits

SYNTRON CO. Pittsburgh, Pa.

ELECTRICITY IS THE MODERN POWER

Facts About Diesel Crane Costs

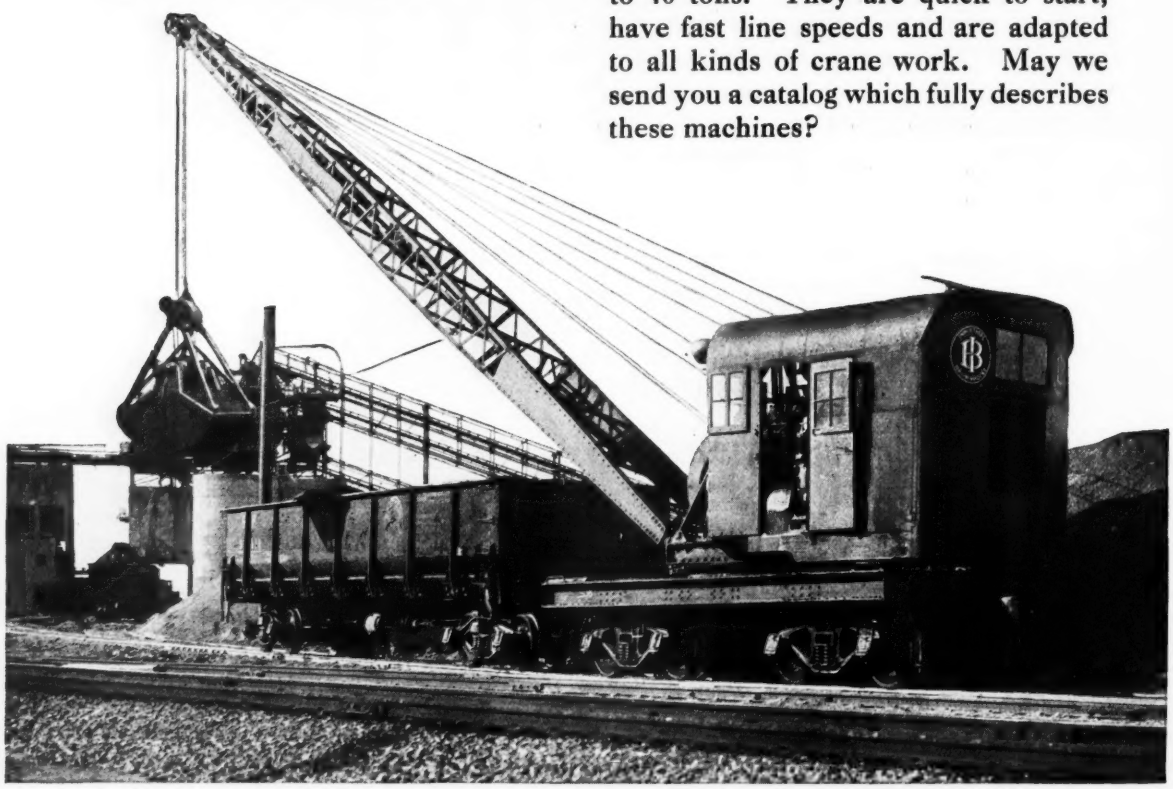
Many crane owners and operators have asked for information regarding Industrial Brownhoist Diesel crane operation—for facts with which their present handling costs could be compared. To these men—and thousands of others who are interested in Diesel crane performance—the figures below will show unusual economies.

The following table gives the actual fuel consumption and operating time on three 25-ton capacity Industrial Brownhoist Diesel locomotive cranes. The figures are those of a large user of cranes and cover an average month of 26 eight-hour working days.

	Crane No. 1	Crane No. 2	Crane No. 3
Hours Worked	199	196	207
Fuel Oil 8 hours (aver.)	17.6 gal.	17.0 gal.	15.5 gal.
Lubricating Oil 8 hours (aver.)	.5 gal.	.5 gal.	.5 gal.

Figuring the cost of fuel oil at five to ten cents per gallon (depending on your location), these Industrial Brownhoists cost from one to two dollars per day apiece for power. Considering their heavy-duty, six-cylinder engines, this cost is remarkably low.

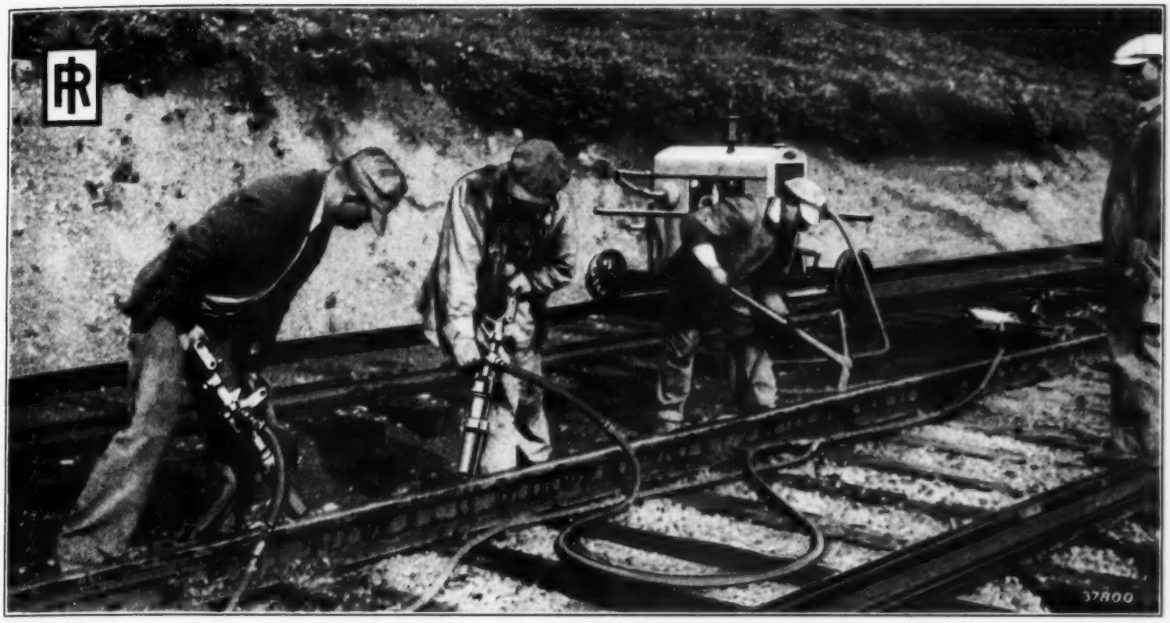
Industrial Brownhoist Diesel cranes are built in capacities ranging from 15 to 40 tons. They are quick to start, have fast line speeds and are adapted to all kinds of crane work. May we send you a catalog which fully describes these machines?



Industrial Brownhoist Corporation, General Offices, Cleveland, Ohio

District Offices: New York, Philadelphia, Pittsburgh, Detroit, Chicago, New Orleans, San Francisco, Cleveland.

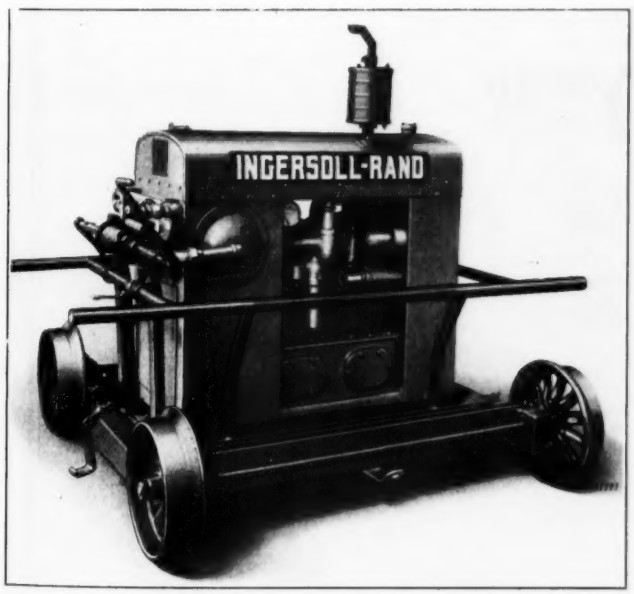
INDUSTRIAL BROWNHOIST



"Smoothing-up" track with a Spottamper outfit.

The "SPOTTAMPER"

A small compressed air outfit for "tamping-up" low spots in track and for other light work on track, bridges and buildings



The SPOTTAMPER compressor.
Note the new hand winch and flanged wheel railroad mounting.

The Ingersoll-Rand small two-tool pneumatic tamping outfit (known as the **Spottamper)** has now been improved to facilitate easier handling on and off the track.

A hand winch and a detachable railroad mounting are provided so that two men can quickly and safely handle the unit on and off the track or up and down slopes. One man can readily move it along the shoulder of the track.

A new pamphlet, Form 1907, describing the latest "Spottamper" and its uses, has just been prepared. Ask for a copy.

INGERSOLL-RAND COMPANY
11 Broadway **New York City**

Branches or distributors in principal cities the world over.
For Canada Refer—Canadian Ingersoll-Rand Co., Limited, 629 Cathcart Street, Montreal, Quebec.

288-TT

Ingersoll-Rand

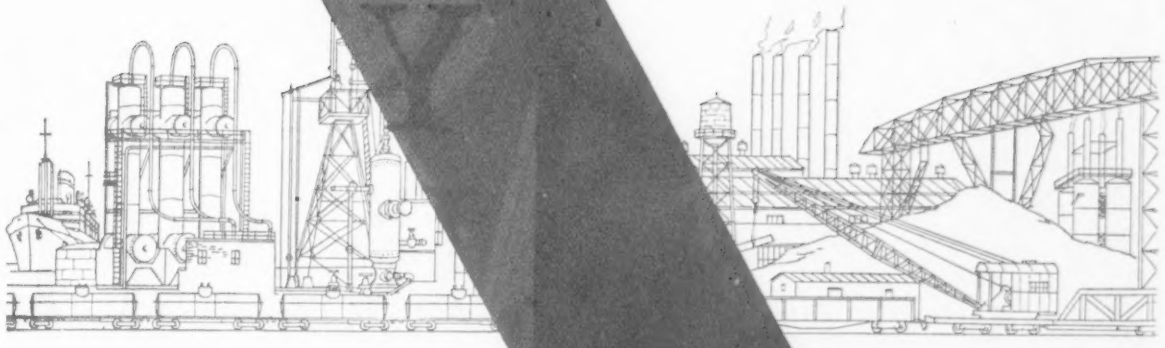
For nineteen years, The Oxweld Railroad Service Company has contributed to the efficiency of American railroads by providing them with the best methods and materials for oxy-acetylene welding and cutting. Year after year, the majority of Class I railroads are finding Oxweld Railroad Service of increasing value.

THE OXWELD RAILROAD SERVICE COMPANY
Unit of Union Carbide and Carbon Corporation

UCC

NEW YORK, Carbide and Carbon Building
CHICAGO, Carbide and Carbon Building

WHERE RED SIGNALS SAFETY . . .



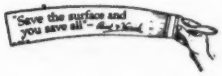
JUST as the coastwise skipper breathes more easily when he "picks up" the oscillations of a charted beacon, so does the maintenance man feel more secure when he sees that his iron and steel structures have their protective coatings of pure red-lead.

For engineers and maintenance men in all fields have learned that pure red-lead defeats the destructive forces that bear the names of weather, corrosion, rust.

Dutch Boy Red-Lead is a fine, uniform, highly oxidized pigment that furnishes an elastic, durable coating that sticks tight—that protects completely—that wears long.

You can buy Dutch Boy Red-Lead in either paste or liquid form. The paste—Red-Lead-in-oil—is easily thinned to brushing consistency. It comes in the natural orange-red and it can be shaded to darker colors. Dutch Boy Liquid Red-Lead is supplied in six colors—orange-red, two shades each of green and brown...and black.

We invite you to consult our Department of Technical Paint Service about your metal painting problems. Also, ask our nearest branch for helpful booklet—"Structural Metal Painting".



DUTCH BOY RED-LEAD

NATIONAL LEAD COMPANY

New York, 111 Broadway—Buffalo, 116 Oak St.—Chicago, 900 W. 18th St.—Cincinnati, 659 Freeman Ave.—Cleveland, 820 West Superior Ave.—St. Louis, 722 Chestnut Street—San Francisco, 2240 24th Street—Boston, National-Boston Lead Company, 800 Albany Street—Pittsburgh, National Lead & Oil Company of Pa., 316 Fourth Avenue—Philadelphia, John T. Lewis & Bros. Co., Widener Building.

SAVE YOUR RAIL ENDS

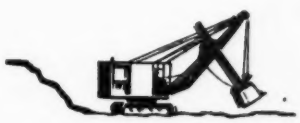
The Rail Joint Company
165 Broadway New York, N. Y.

HEADFREE RAIL JOINTS

Pennsylvania R.R.

has been buying Bucyrus-Eries for over 40 years

This huge corporation's success, in no small measure, lies in the careful selection of equipment. Their satisfaction with Bucyrus-Eries is indicated by repeated purchases of this equipment since 1890.



BUCYRUS-ERIE COMPANY, South Milwaukee, Wisconsin

Representatives throughout the U. S. A. *Branch Offices:* Boston, New York, Philadelphia, Atlanta, Birmingham, Pittsburgh, Buffalo, Detroit, Chicago, St. Louis, Kansas City, Mo., Dallas, San Francisco. Offices and distributors throughout the world.

A-312

BUCYRUS ERIE

VERONA RAIL JOINT SPRINGS

Maintain Important 20,000 to 10,000 Pound Bolt Tension Longer Than Helical Nut Locks

VERONA RAIL JOINT SPRING SUPERIORITY

FIRST. More Uniform Bolt Tension.
SECOND. Less Bolt Tightening Labor.
THIRD. Longer Life of Rail and Joint Fastenings.

VERONA TOOL WORKS

1800 First National Bank Building
PITTSBURGH, PA.
"1873"

ATLACIDE
CALCIUM CHLORATE

3 to 5 Dollars per Mile

will kill weeds on the right of way outside the ballast area

THE ATLACIDE Dusting Method is the most economical for killing weeds around

- Loading Platforms
- Cattle Guards
- Switch Stands
- Drain Ditches
- Culvert Ends
- Lumber Piles
- Fence Lines
- Tie Piles
- Pole Lines
- Mile Boards
- Signal Poles
- Bridge Bases
- Water Towers
- Storage Yards
- Whistle Boards
- Yard Limit Boards

Here's How

ONE Knapsack Duster ($20.00) will service three sections at an average cost of $1.00 per mile for the duster.

A 200 lb. drum of Atlacide ($18.00) covers 20,000 to 30,000 square feet and will rid the average right of way section of all the weeds as listed on the margin at a cost of about $3.00 per mile for chemicals. Total cost about $4.00 per mile.

Double the amount of Atlacide and you can kill the occasional patches of weeds in the ballast section.

One man with Knapsack Duster does the work of 5 men cutting weeds. The results from the Atlacide dusting method are permanent.

Order some and make the test on some of your difficult sections.

Chipman Chemical Engineering Co. Inc.
BOUND BROOK, N. J.
Chicago, Ill. Palo Alto, Cal. Houston, Tex. Atlanta, Ga. Kansas City, Mo. Winnipeg, Man.

SUCCESSFUL FOR 21 YEARS

MEDUSA

Waterproofed Cements

defy TIME *and* TEMPEST

When building, use Medusa *Waterproofed* Portland Cements (White and Gray) for concrete construction, masonry mortar, and Portland Cement Stucco. This will assure dry walls below and above grade for all time. These *Waterproofed* Portland Cements are manufactured by grinding in Medusa Waterproofing with Medusa White and Gray Portland Cement during the process of manufacture. These Medusa *Waterproofed* Portland Cements have been "SUCCESSFUL FOR 21 YEARS." The interesting story of this permanent method of *Waterproofing* concrete and mortar is told in the Medusa Book "How to Make Good Waterproofed Concrete." A complimentary copy of this book will be sent upon request, without obligation, to those interested in building.

MEDUSA PORTLAND CEMENT COMPANY, 1002 Engineers Bldg., Dept. O, Cleveland, Ohio

Manufacturer of Medusa Gray Portland Cement (Plain and Waterproofed); Medusa Waterproofing (Powder or Paste); Medusa White Portland Cement (Plain and Waterproofed); Medusa Portland Cement Paint; Medusa-Mix, the Masonry Cement; and Medusa StoneseT Cement.

MEDUSA

WATERPROOFED PORTLAND CEMENTS

• *White and Gray* •

Originated by Medusa—Proved by Time

Rail Laying at Sixty Rails per Hour

By **John Kiley**

"To tell the story of the development of the modern rail laying operation as performed on the Boston and Maine is to record five years of study, planning and research.

"Briefly, the operation, which is unique and notable in many respects, is the outcome of an idea that the old-established methods of rail renewal were no longer justified from the standpoint of economy, advantage to the Operating Department and fairness to the Maintenance men. . . .

"Inventive genius recognizing the problems of the Maintenance men responded nobly and gradually there was introduced into the field of rail-laying an imposing array of mechanical equipment—gasoline driven spike pullers, pneumatic spike drivers, pneumatic nut runners, the "Burro" Crane and its big brother, the locomotive crane, power drills, the acetylene torch for cuttiing and bonding, and the adzers powered by gasoline engines — all mounted on wheels, presenting a complete mobile and flexible rail laying plant. . . .

"The real story lies in figures and the followiing tabulation indicates the progress made in perfecting performance during the three-year period of 1929-1930 and 1931 to date."

	Av. Ft. of Rail per Day	Av. Tons of Rail per Day	No. of Rails per day	Ft. per Man Hour	Av. Hours Worked per Day
1929	12,962	250	332	5.75	11.86
1930	14,480	280	372	8.12	10.00
1931	22,568	436	583	14.39	10.14

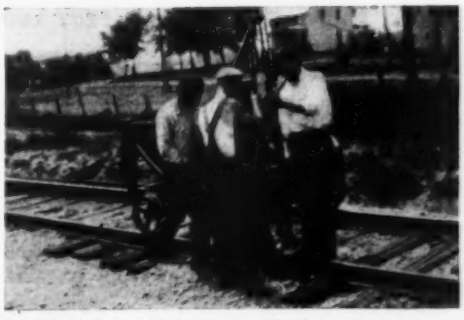
*Extracted from Boston and Maine Railroad Employees' Magazine.

The Editor "hollered" for this story!

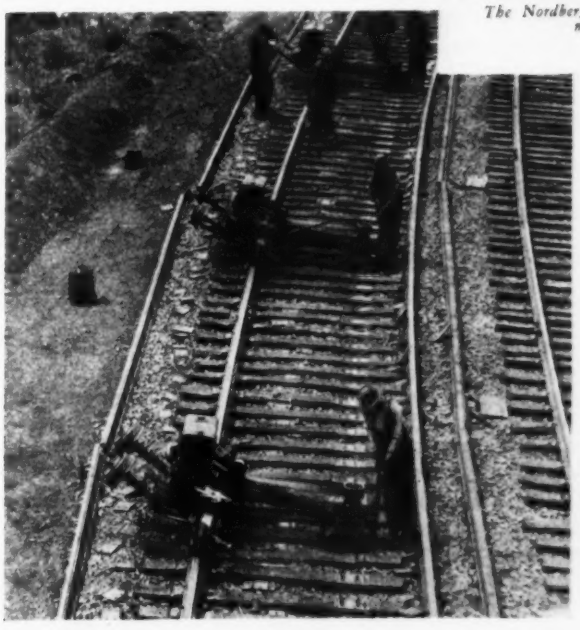
A good editor can sense a "hot" news story a long ways off. And when the editor of the Boston & Maine Employees' Magazine heard about his own company laying rail at the rate of a rail a minute, he commissioned John Kiley to get the facts.

Conditions were practically made to order for Nordberg power machines. Three Nordberg Spike Pullers pulled 69 spikes per minute. Three Nordberg Adzing Machines adzed 33 ties per minute.

Speed—safely, sanely and satisfactorily! And track with better "staying power"!



The Nordberg Spike Puller does not mutilate ties.



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No. 32 of a series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING COMPANY

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: In the Far Corners of the Earth

July 27, 1931

Dear Reader:

Although we have primarily in mind, when selecting material for publication in Railway Engineering and Maintenance, the needs of the officers on the railways of North America – Canada, Mexico and the United States – I confess to a considerable amount of pleasure that a growing list of railway officers in other countries, now number more than 300, are finding this material of equal interest and value. These men are scattered over the globe, from Leningrad to Cape Town – from Tokyo to Berlin.

Take, for instance, Kazuo Tsukamoto of Osakafu and his 77 fellow subscribers on the railways of Japan and Chosen (Korea), or T. C. Chi, division engineer of the Tientsin-Pukow railway at Liang-Wang Chuang and his 28 railway associates in China who receive the paper monthly, or the 25 Russians who direct the Soviet railways from such centers at Leningrad, Moscow and Dnepropetrowsk to Vladivostok. Likewise, the paper is found on the desks of officers of the Indian railways in such widely scattered centers at Calcutta, Bombay and Lahore.

In Australia we serve, among others, the general manager of the Queensland railways at Brisbane, and the chief engineer of the Victorian railway at Melbourne, as well as R. Dunford, roadmaster on the Commonwealth railway at Port Augusta, while in New Zealand, the chief engineer and six district engineers of the government railways subscribe regularly. In Africa we are glad to number among our numerous subscribers the chief engineers of the Rhodesia railway at Bulawayo, of the Nigerian railway in West Africa, and of the Kenya & Uganda railway at Nairobi, East Africa. Likewise, in Palestine the general manager at Haifa, in Siam the chief engineer at Bangkok, at Baghdad the chief engineer of the Irak railway, and in Turkey the general manager at Izmir are included in our circulation.

To those of our circle of readers in the remote corners of the earth we feel a responsibility greater even than to those at home, because of their very inaccessibility and lack of contact with other railway men. Incidentally, the distribution of our paper throughout the farthest parts of the world in this way, cannot be other than an effective messenger of American methods and American equipment.

To you in the far corners of the earth we extent special greetings.

Yours very truly,

Elmer T. Howson

ETH*JC

Editor.

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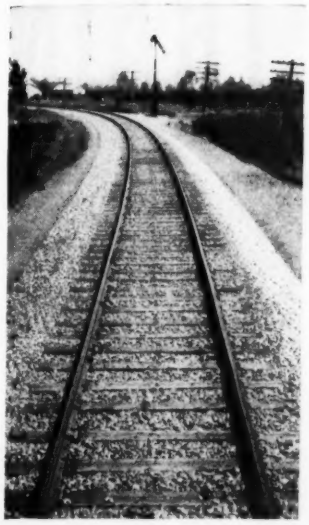

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Railway Engineering and Maintenance

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AUGUST, 1931

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ELMER T. HOWSON
Editor

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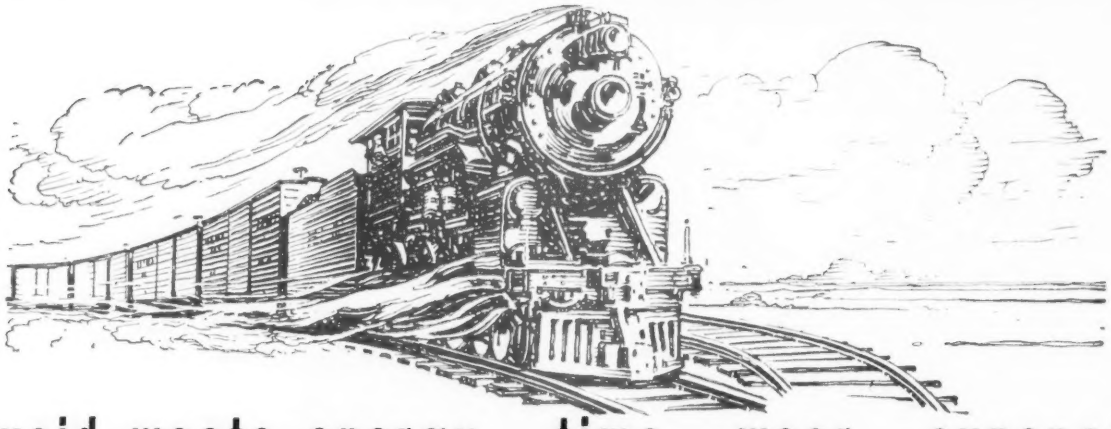
DON'T STOP THIS TRAIN



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Railway Engineering and Maintenance

WHOSE PROBLEM?

The Question of Adequate Return

ON JUNE 17 the railways of the United States unanimously petitioned the Interstate Commerce Commission for an increase of 15 per cent in freight rates. In presenting their petition, the representatives of the railways asked that the commission consider it as an emergency measure and give it prompt consideration. In support of their petition, the roads pointed out that in 1930 their net operating income decreased 30 per cent from that of 1929, and that during the first five months of the present year, it has declined 40 per cent from that of the corresponding period of 1930. As a result, their margin over fixed charges has been lowered to a point which threatens the solvency of numerous carriers.

Of Widespread Effect

This is the present plight of the roads. Its correction is the concern of every railway employee. It is of equal concern to every employee of a manufacturing concern which derives its business entirely or in part from the railways. It is their concern also to understand the ramifications of this problem in business at large and its effect on our citizens as a whole in order that all those whose interests are affected may be aroused to the seriousness of the present crisis.

To the layman in other avenues of industry, and possibly even to some within the railway industry itself, the present situation may be thought to be of concern only to those officers charged with responsibility for management and to that undefined aggregation of wealth commonly referred to as Wall Street. This is one of the dangers of the situation, for it is far from the truth, as even a casual analysis will show.

The Employee

Take the railway employee himself. His numbers have been reduced more than 325,000 in the last two years. In the maintenance of way department alone, the reduction in forces in this period has approximated 110,000 or nearly 30 per cent. Furthermore, many of those still retained are working reduced hours in order that the expenditures may be kept within the amounts available for such purposes. To those persons who have been laid off or who have had their wages reduced, and to their families, the necessity for increased freight rates is no longer open to argument.

There is another large group to whom the present situation is of almost equal concern. This is the stockholders, the people who own these properties and whose savings are invested in them. It is impossible to determine the number of these stockholders with any degree of accuracy. It is commonly estimated, however, that their number exceeds 1,000,000 persons. Who are these people?

There has long prevailed a general impression that they are people of large wealth who are enabled by reason of their dividends to live lives of idleness at the seashore. Yet the facts are otherwise. Take as an illustration the Pennsylvania, America's largest railway system, measured in investment. In his last annual report, President Atterbury called attention to the fact that this road was owned on December 31 last by 233,414 different stockholders, and that the average number of shares held by each stockholder was 55.9. Since these shares are of $50 par value, the average investment per stockholder was less than $2,800, and the average return received by each stockholder last year was less than $225, surely not large sums. Further, as with many roads, no small proportion of these stockholders are employees, this group on the Pennsylvania constituting 22 per cent of all stockholders.

That the stockholders are, like the employees, suffering from the decreased earnings of the railways, is evidenced by the reduction within recent weeks of the dividend rates per share paid by a number of the largest railways, that of the Pennsylvania having been reduced from $4 to $3, a decline in income for the stockholders of 25 per cent. In addition, the market price of this stock per share, or the price which a stockholder can secure for it, has declined $18 per share or nearly 30 per cent since the early part of this year. The stockholder therefore has a direct interest in the railways' application for increased freight rates.

Insurance Companies

There is still another group of our citizens to whom the situation is of vital concern. This is that large number of persons whose savings are invested in whole or in part in life insurance companies and in mutual savings banks, and to whom the financial security of these companies is paramount. In testimony presented at the hearing in Washington a few days ago by representatives of these two groups, it is stated that they have total

assets of approximately $30,000,000,000, representing the savings of at least half the people of the United States, and that of these assets approximately $4,700,000,000 consists of railway securities. If to these be added the securities held as investments by banks to secure deposits, a total of between $6,000,000,000 and $7,000,000,000 of the total of $11,500,000,000 of railway bonds outstanding is invested by or for the protection of a large part of our public.

The requirements of the state of New York for investments permissible for insurance companies, banks, etc., are commonly considered as the criterion throughout the country. These requirements provide that for the securities of a railway to be a legal investment for such purposes, that road must have earned its fixed charges one and one-half times during five of the preceding six years, including the one next preceding, and have paid dividends on its stock equivalent to one-fourth of its fixed chargess in five of the six years. In its appearance before the Interstate Commerce Commission, the committee representing the investment companies and savings banks showed that in the five calendar years ending December 31, 1929, the roads earned their fixed charges 2.12 times, while in 1930 they earned them only 1.76 times, and in the first five months of 1931 only 1.27 times. Furthermore, the committee continued, 20 of the 67 largest roads of the country will not earn their fixed charges in 1931 and only 21 will earn them 1½ times or more.

Of the 35 roads whose securities are now on the legal list, 21 may be stricken off next year. The aggregate amount of the securities that would be removed from the approved list by such action totals $5,748,500,000. The disastrous effect of any movement by these insurance companies and banks to unload this tremendous volume of securities on an already stagnant market is self-evident. Such action would likewise shut off from the railways the flow of capital that is so necessary to the maintaining of an adequate national transportation system.

A Problem for All

Taking all of these groups, more than 40 per cent of our entire population has a direct financial interest in the solvency and success of the railways, entirely aside from the almost complete dependence of our entire population on the service rendered by the railways for our very sustenance. It is to these people, employees, stock and bondholders, investors in life insurance companies, savings banks, etc., that the present financial plight of the roads should be of vital concern.

Railway managements are charged by law with responsibility for the operation of the properties in an efficient manner. That they have made a remarkable record in this respect has been attested by President Hoover, Secretary of Commerce Lamont, and by the Interstate Commerce Commission itself. Yet, in spite of their best efforts, their return has fallen below the level of safety. Relief is necessary. The only recourse is to the commission. If the railways are to be restored to a prosperous condition, employees must make it their business to see that those with whom they come in contact are informed as to the facts mentioned above. This is a measure of support which they owe to their managements and to themselves.

DRY WEATHER

Recovery From Drought Is By No Means Complete

WHILE the rainfall of the past winter and spring may be said to have broken the record drought of 1930, conditions have not been altered to a degree that permits of unalloyed complacence. In the first place, the rainfall that has occurred in the areas that were embraced in last year's drought, has in most cases exceeded the normal fall by only a small margin. Furthermore, certain localities in these areas have suffered a deficiency in precipitation this year to an extent that is injuring crops. Thus, although most of the areas that were affected last year, have had enough rainfall during 1931 to support vegetation, the precipitation has not been in sufficient volume to compensate for the shortage of a year ago, and as a consequence, ground water levels are still low, stream flow is subnormal and reservoirs in some localities contain supplies that are still but little above the danger level.

On the whole, therefore, the situation is one that calls for continued caution in the consumption of available water supplies and a readiness to meet shortages as they occur. Nor is the fire hazard a matter to be taken lightly. Not only in the northwest where dry weather has resulted in forest losses recalling those of two years ago, but in agricultural regions where rainfall is now deficient, every effort must be made to guard against fires from any cause. The need is particularly severe this year because of the limited forces available for fighting a fire on the right of way that is not apprehended until it has gained considerable headway.

RAIL BATTER

How the Section Forces Can Minimize It

EXCEPT on curves, rail is seldom removed because of wear. Disregarding defective rails and those that are damaged accidentally, since they comprise only a small percentage of the whole, the principal causes of removal are battered and chipped ends. It becomes important, therefore, to consider what the section forces can do to eliminate or minimize these forms of damage.

Assuming that all precautions have been observed in laying the rail, to obtain the correct expansion and hold it uniform by the immediate application of anti-creepers, and that the rail has been properly gaged, surfaced and lined, it becomes the responsibility of the section forces to maintain it in such a manner as will prolong its life to the practicable limit.

Loose bolts, unsound or loose joint ties and poor surface, either alone or in combination, tend to accelerate rail batter. For this reason, they should be given preferred attention in any maintenance program. There are no special difficulties involved in keeping bolts tight, provided this is done from the start. The desirability of sound ties under joints is too well established by long experience to require comment, yet it is surprising how often this important matter is neglected. Foul ballast, pumping joints or imperfectly tamped ties cause excessive vertical movement of the rail at the joint, the

result being abnormal wear on the angle bars and, not infrequently, surface bending of the rail ends, both of which tend to increase the rate of batter.

Correct gage, good line, snug spiking, the proper application of joint tie plates, correct and uniform expansion and the elimination of creeping by the use of sufficient anti-creepers all have varying degrees of influence in minimizing the rate of batter. It is generally conceded that the chipping of the rail ends is a corollary of joint batter, although chipping sometimes occurs from longitudinal flow of the metal, even where there is no perceptible batter.

It is apparent that, while the section forces cannot prevent rail batter, they can do much to retard its progress. The important thing in this connection, however, is that in doing so they are not required to adopt any special methods. Every item which has been mentioned as influencing the rate at which batter occurs, is a matter of routine maintenance. For this reason, all that is required of these forces in the discharge of their responsibility in this respect is that they do not neglect any of these items, but that they give them the close attention which their importance demands.

SORTING SCRAP

Usable Material Should Never Be Included

IT SHOULD be a fundamental rule that all second-hand track material that is suitable for further use should be preserved and utilized as speedily as practicable. Unfortunately, the importance of doing this is not always appreciated, with the result that there is a definite loss to the railway in every failure to make the proper segregation between usable material and scrap.

Section foremen should be educated to distinguish between these two classifications and should be required to segregate them at the time of their collection. This is almost entirely a matter of supervision and the results on any district are a measure of the activity of the supervisor and division engineer in this respect. Only scrap material should be sent to the reclamation plant, the remainder being retained on the division on which it was released, except rail and fastenings released when laying rail.

If, for any reason, there is an accumulation beyond reasonable current needs, a list should be prepared showing the amount on hand for each item, its location and the class of work for which it is suitable. From the several lists thus prepared, either the stores department or the engineer maintenance of way can compile a consolidated list for the information of the various divisions on the system, with the purpose of insuring a quick turnover.

An instance of failure to segregate scrap and usable material came under observation recently. The supervisor on a district upon which a reclamation plant is located, was desperately in need of spikes and bolts to lay a mile of rail and could not obtain the necessary new material for some time. Under an arrangement with the reclamation plant, he sorted out enough first class bolts and spikes from an unworked scrap pile to lay this rail, and also four additional miles, and then secured sufficient additional supplies to meet all of his maintenance requirements for the season.

Undoubtedly this was an aggravated case, but it provides a good illustration because it is not altogether an isolated one. The most startling feature, however, was that all of the material thus reclaimed was perfectly good, while a considerable part of it had never been in use. Managers of other reclamation plants know of cases to match this one.

ECONOMIES

Pumpers' Daily Reports Help to Produce Them

NO operation can be completed efficiently or economically unless it is systematized. As a corollary, it cannot be systematized properly unless all of the facts connected with it are known. It is only in recent years that the water-service department has been given the recognition that its importance deserves. Prior to this time, pay rolls may have been scrutinized from time to time, but little was known about other expenditures or their purpose, except by the local officers in direct charge of the work and few of them kept records of the performance of the water stations under their charge.

Furthermore, the policy was to operate the stations at the least cost for labor and materials, with the result that much obsolete equipment was retained until its physical condition demanded replacement, and this was often made with no thought of possible economies. As the water service is becoming better organized and brought to the level of other departments, new policies are being formulated and obsolete and ineffective methods are being discarded. It is easy to understand, however, that although many of the lax methods of former days have been corrected, some of them still persist.

As an illustration, it is only recently that the importance of daily reports from pumpers, which should include the amount of water pumped and the supplies used, has been appreciated. Not all roads require such reports, but those that do find them useful in several ways. First of all, a perusal of these reports will enable the officer who receives them to detect any unusual conditions at once, which conditions can be investigated further or corrected immediately as the facts may warrant. Again, these reports make it possible to compare the performance of all of the pumpers on a given territory, particularly those who are provided with similar equipment. Special attention can then be given to those whose work is least satisfactory with a view to educating them to the point where they will give at least average performance.

As reports of this character are kept over a period of years, they become of increasing value as a basis for recommendations for improvements, extensive repairs or replacements, since these recommendations can be based on facts and not entirely on opinion. It is difficult to conceive how an officer who is responsible for the performance of water-supply facilities can expect to carry on his work intelligently without some system of daily reports which will show what has happened and is occurring at the individual stations in the entire territory under his jurisdiction.

Effective Oiling Equipment Used on B. & M.

Over 1,200 miles of line treated last year with newly developed car which has now been equipped to oil the rail and fastenings

Oiling Track on the B. & M. During 1930 Before the Car Platforms Were Enclosed

REVIVING with better results a practice which proved rather unsatisfactory some years ago, the Boston & Maine, in 1930, oiled more than 1,200 miles of roadbed with a specially designed oiling car in an effort to lay the dust on those sections of its more important passenger lines not ballasted with crushed rock or washed gravel, and thereby make passenger travel more comfortable and enjoyable. The oiling car, which applied the oil hot through cone sprays, traveled at an average speed of 18 m. p. h. and oiled the full width of the roadbed or the track center alone, as desired, with a crew of only four men. Altogether, more than 700,000 gal. of oil was applied, at a total cost for labor, equipment and oil of approximately $27,000.

New Oiling Car Used

To carry out the oiling work, the Boston & Maine designed and equipped its own oiling car with the idea of embodying in it recognized features of best construction, plus certain special features to make it most effective and economical of operation. While highly successful in the oiling work of 1930, a number of improvements were made in the equipment during the last winter with the idea of securing even more successful results and greater economy of operation. Special piping and fittings were also added for the oiling of the rail and track fastenings, this additional operation having been decided upon for certain sections of the road, especially in tunnels where corrosion has been found to be particularly severe.

The car itself, which was developed from a standard box car, was rebuilt and equipped at the Concord car shop of the road in about three weeks time. The fundamental changes made in the car were to provide it with operating platforms at each end, sheltered by the car roof, with windows and end doors, and the addition of four large metal-lined sand bins. The operation of the car during 1930 proved the desirability of closing in the rear of the platforms to shield the operators from a certain amount of fine oil spray that prevailed around the operating end of the car during oiling, and this change has been made, the enclosure in each case being effected by a more or less standard car end fitted with three windows, each about 18 in. square.

The oiling equipment and piping installed in the car are such that oiling can be done from either end of the car and over the full width of the roadbed or over the ballast shoulders or immediate track surface alone, as desired. Essentially, it consists of a gasoline engine-operated Blackmere steam jacket rotary pump installed near the center of the car, with a four-inch intake line along the floor of the car equipped with two gate valves and an oil strainer, and three-inch discharge lines extending from the pump to each end of the car. The discharge lines are located a few inches above the floor, and, at the ends of the car connect with systems of spray pipes for applying the oil to the roadbed or to the rail and fastenings. The pump is equipped to operate continuously and to by-pass oil when shut-off is made for highway crossings, switches, etc.

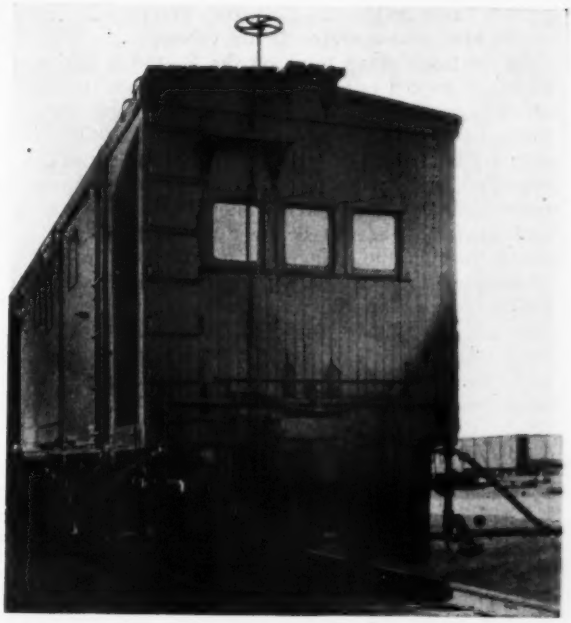
In the direct track oiling arrangement, the three-inch discharge line to each end terminates in a reducing tee, from which horizontal lengths of two-inch pipe, each equipped with a quick-acting plunger valve, carry the oil to the sides of the car. At these points, two-inch pipes extend down to within ten inches of the top of rail and are connected across the track at this level by a two-inch spray pipe fitted with ¾-in. Spraco spraying nozzles, with 11/32-in. orifices. These nozzles, which give a true hollow cone spray, are spaced eight inches center to center.

From swivel valve fittings at the lower ends of the down-coming pipes along the sides of the car, four-foot wing lengths of two-inch spray pipe are attached for oiling the track shoulders and intertrack space, each of these extensions being equipped with six ¾-in. Spraco nozzles, spaced eight inches center to center, and a pipe

cap at the end. The total length of spray piping across the track, as originally designed, from the ends of the wing sections when they are fully extended, was 17 ft., with 22 nozzles. Provision was made, however, after the car was put in service, to lengthen each wing by an additional six-inch section of pipe, equipped with one spraying nozzle, thereby increasing the total width to which the roadbed could be oiled to 18 ft.

The wing sections, as shown in the accompanying illustrations, are held in a horizontal position by steel bar tie rods, through which they are operated outward, or forward or backward by means of hand brake staffs mounted at the corners of the car. These brake staffs, which are equipped with hand wheels, extend down to a point below the frame of the car and have operating connection with the wing sections through chain and sprocket arrangements at the top of the tie rods carrying the wings.

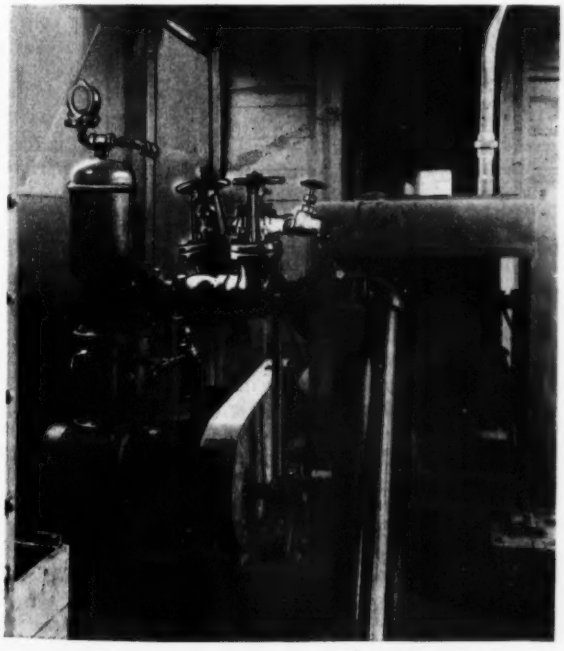
By means of the two quick-acting hand valves in the two-inch line across the rear of the car platform, the flow of oil to all the nozzles of the spraying system can be regulated. This applies equally to the wing spray nozzles, although through the installation of swing valve connections on the wing sections, the oil to them is completely shut off automatically, entirely independent of the control of the oil from the stationary spray pipe, when the wing sections are swung either forward or backward in line with the sides of the car.



The Oiling Car After the Platforms Were Enclosed, Showing the Wing Pipes Extended to Their Full Width

Details of Rail Oiling Equipment

The rail oiling system, which is entirely independent of the track oiling pipe system, is the same at each end of the car and consists essentially of a 1½-in. pipe leading down to each rail, feeding oil to two ¾-in. Spraco nozzles directed against the sides of the rail. The take-off in the rail oiling system at each end of the car is through a short vertical length of two-inch pipe direct from the main three-inch supply line from the pump. At the top of the take-off pipe, which is equipped with a globe valve, lengths of two-inch rubber-covered canvas hose extend horizontally to connections with the vertical lengths of 1½-in. pipe which carry the oil down to the rail level. At the lower end of each of these lengths of pipe there is a spring plunger valve and a suitable arrangement of short lengths of pipe and fittings, terminating in spraying nozzles, which carry the oil to each side of the rail in such a manner that the oil spray is directed against the web and base of the rail. The range of the cone oil spray is such that it takes in the full height of the rail web and the outer edges of the tie plates. Some little stray spray exists about the rails during oiling operations, especially if a high wind is blowing, but oil is kept from the tops of the rail heads by means of curved metal shields, about a foot long, which lie close to the rail while oiling is underway.



Interior View Showing the Oil Pumping Equipment

A feature of the rail-oiling equipment is the fact that the entire system, up to the hose connections with the supply line, is movable vertically in guides to enable the spray heads to be raised when passing through switches, frogs, highway crossings, etc., this movement being affected through a single hand lever on the platform of the car. Combined with the raising action of the piping system is the control of the flow of oil to the spray nozzles, this being effected through the spring plunger valves at the lower ends of the 1½-in. supply lines, which are closed automatically with the raising of the piping system and remain closed as long as the system is held above its normal operating position. With the lowering of the oiling system through release of the hand operating lever, the valves open automatically and spraying of the rail is resumed. The only use made of the main valve in the rail oiling system supply line is in opening the system at the beginning of operations and in closing it off when oiling is stopped for the day.

Sanding of the rails to pick up any oil which may have been blown on the surface of the rail head and to restore normal traction, is provided through a sanding system at each end of the car, with sanding pipes leading down to each rail just behind the car trucks. Sand flows to the rails through standard air-operated locomotive sanding valves, the two valves at each end of the car being operated simultaneously by an air

control valve on the car platform, directly within reach of the man who operates the oil valves.

In the track oiling work on the Boston & Maine, the oil car is moved in a work train with from two to five oil tank cars, the number of cars depending upon the amount of oiling to be done during the day. Only those sections of track still ballasted with bank run gravel are oiled, and the oiling is done late in the spring or early summer, immediately following tie renewals and such surfacing as can be done, so that the value secured through the oiling will not be lost through the disturbing of the ballast after the oil has been applied. One application of oil a year was found sufficient, except on those sections of track where it was necessary to disturb the ballast extensively for one reason or another after the first application was made.

The oil used in the oiling is a quick-drying heavy road oil prepared to the following specifications:

Specific gravity	0.988
Flash point	over 200 deg. F.
Specific viscosity at 50 deg. C.	45
Loss at 163 deg. C. ..... 5 hr.	10.30 per cent
Total bitumen	99.93 per cent
Total bitumen insoluble 0.86 per cent naphtha	11.18 per cent
Asphaltic content at 100 p. r. n.	67 per cent

The purpose of using this heavy oil is to secure a film of oil on the roadbed which will not be disturbed with the passage of high-speed passenger trains.

In order to make the heavy oil used readily applicable, it is heated to temperatures ranging from 170 deg. F. to 200 deg. F. This is done through the steam heating coils provided in the tank cars in which the oil is received, which are connected with a steam line at a terminal or other point for about 18 hours before oiling is begun. The oil is kept to the proper heat out on the line during oiling operations by steam from the train steam line.

In order that the oil will not congeal in the cold pipes of the oiling system when the oiling is first started, the entire piping system, including the oil jacket of the pump, is connected up with the steam line of the train so that the system can be heated thoroughly before the oil is put through it. Steam is also blown through the entire system on the completion of oiling operations for the day to preclude any clogging which might otherwise occur.

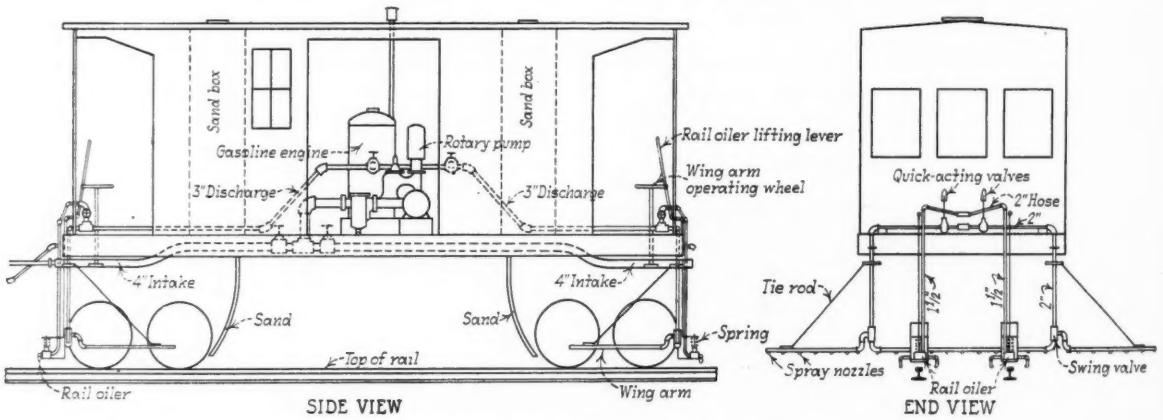
At temperatures between 170 deg. and 200 deg., the oil flows quite readily by gravity, but not sufficiently well to give spray action at the spray nozzles. Therefore, about five pounds pressure is introduced into the tank car being unloaded, which assists the flow of the oil to the rotary pump in the oiling car, where the pressure to the spray nozzles is built up to about 60 lb.

In addition to the train crew, only five men are required on the oil train, this force including the track supervisor on the territory on which the train is being operated. The other four men include a man to operate the oil valves and the sand valve on the rear platform, another man who looks after the operation of the gasoline engine and the pump, and two men who operate the shoulder oiling wings to regulate the width oiled and to avoid obstruction. The supervisor accompanying the car has direction over its operation and, because of his familiarity with his territory, he is in a good position to point out not only the sections of track which need oiling, if out-of-face oiling is not necessary, but also the places where heavy or light applications should be made.

While the speed of the train and, therefore, the amount of oil applied per lineal foot of track, is varied somewhat with the condition of the roadbed, the average speed at which the train is operated is about 18 m.p.h. and the average amount of oil applied per mile of track, full width, is approximately 630 gal. Oiling can be done in a light rain, but is preferably done when the ballast is dry because of the more uniform distribution of the oil over the ballast under this condition.

Records of Operating

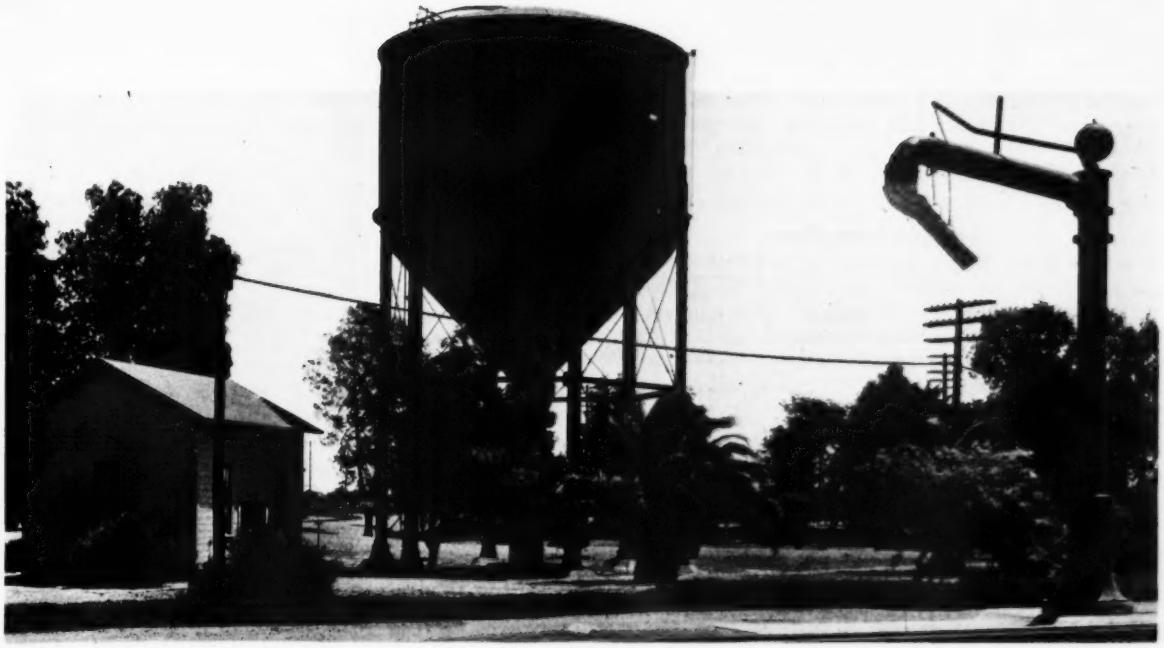
In the work during 1930, over 1,200 miles of track was oiled and approximately 700,000 gal. of oil were applied. Some of the track covered required a second oiling later in the summer, where the ballast had been disturbed unavoidably, but the amount of this subsequent oiling was relatively small in spite of the fact that it was the first year in the operation of the equipment and the work was not as fully co-ordinated with the track work as it will be in the future.



Sketch of Side and End of the Oiling Car Showing the Arrangement of Its Equipment

Records of the oiling work show that the average width to which the track was oiled in the 1930 program was 14.7 ft., and that approximately 121 sq. ft. of track surface was covered per gallon of oil applied. The average cost of the oiling per mile of single track amounted to $26.59, and the average cost of the oil applied, including train service was $.0414 per gal.

The oiling equipment employed on the Boston & Maine was developed under the general direction of H. F. Fifield, engineer maintenance of way, and under the direct supervision of C. L. Fero, general supervisor of work equipment.



The Water Facilities at Davis, Cal., Pump House Also Houses the Zeolite Treating Equipment

Zeolite Plants Effect Economies

Records of 31 installations on the Southern Pacific show marked improvement in water treated and large savings in locomotive boiler maintenance and repair

RECOGNIZING the paramount importance of good water in locomotive operation, the Southern Pacific started the treating of hard water more than 30 years ago, and is today either treating or contemplating treating the water at practically every important point on its lines where the supply is classified as other than good. The outstanding feature of the treating practices is the use of the zeolite method.

The extended consideration given to the water supply on the Southern Pacific applies to the Texas lines as well as the Pacific lines, and the use of the zeolite method of treatment predominates on both. This article, however, deals solely with the water treating plants and practices on the Pacific lines.

Thirty-One Zeolite Plants in Service

For comparative purposes, the water supplies are classified as "good," "fair," "poor," "bad" or "very bad," depending mainly upon the amount of incrustating matter per gallon. Water with 8 grains or less is considered "good"; that with from 9 to 15 grains is considered "fair"; that containing from 16 to 25 grains, "poor"; that with from 26 to 40 grains, "bad"; and that with over 40 grains, "very bad"; these ratings being lowered if the alkali chloride content is high. North and east of Sacramento, Cal., and down the San Joaquin valley, the water supplies are rated, on the whole, either "good" or "fair," although there are a few points where the water is classified as "poor" or "bad." East of Sparks, Nev., and also around San Francisco bay and along the Coast line to Los Angeles, hard water is encountered more often. In the southern part of California and in Arizona, locations with "poor," "bad" and "very bad" water predominate, as they do also in New Mexico, except for those supplies which originate in the snow waters of White mountain.

Several methods of water treatment are employed on the Pacific lines, but the zeolite method perdominates and there are 31 zeolite plants on the road at present. The zeolite installations on the Southern Pacific are comparatively simple and cheap, the cost ranging from approximately $5,000 to $20,000, depending upon the amount of water to be treated and the degree of hardness of the water. Essentially, the plants involve a relatively small zeolite pressure filter with suitable regulating valves, a small brine douching tank and a relatively small building to house the equipment. At the larger stations, a concrete salt-receiving tank, usually 40 ft. long by 10 ft. wide and 6 ft. deep, is provided, where the salt for regenerating purposes can be received in carload lots and converted into brine, ready for use.

Operation of the plants has been found to be so simple and fool-proof that skilled technical operators are not required. During the exchange process, the exchange of sodium in the system for the calcium and magnesium of the untreated water is in the exact relation of the combining powers of these elements, and it is, therefore, impossible to overtreat the water. Under-treatment is avoided by a signal arrangement in which a bell rings when a pre-determined amount of water has passed through the plant, when it is known that the zeolite has reached the limit of its softening power.

In the zeolite plants on the Southern Pacific, the water

treated is reduced to almost zero hardness, and the small amount of hardness remaining, generally silica, alumina and oxide or iron, is ineffective in the formation of scale in the absence of a binder such as the calcium and magnesium carbonates and sulphates. No precipitation takes place as a result of the introduction of sodium in the regeneration process, as the calcium and magnesium carbonates and sulphates are converted into sodium carbonates and sulphates, which remain in solution.

List of the Zeolite Plants

Point	Source	Total Grains of Incrustants Per Gallon	Gal. Treated Per Day
West Oakland, Cal.	Water Company	11.14	724,000
West Oakland, Cal. (creo. plant)	Water Company	11.14	36,000
West Oakland, Cal. (laundry)	Water Company	11.14	39,000
Davis, Cal.	Well	14.86	43,000
Port Costa, Cal.	City Supply	16.03	328,000
San Francisco, Cal.	Wells & City Supply	11.89	493,000
San Jose, Cal.	City Supply & Well	10.84	479,000
Tracy, Cal.	Well	18.89	469,000
Watsonville Junction, Cal.	Well	18.48	355,000
San Luis Obispo, Cal.	Well	33.94	395,000
Surf, Cal.	Well	19.24	133,000
Fresno, Cal.	City Supply	11.61	297,000
Santa Barbara, Cal. (station)	City Supply	25.53	117,000
Santa Barbara, Cal. (enginehouse)	Well	21.63	108,000
Oxnard, Cal.	Well	33.58	83,000
Los Angeles, Cal. (station)	City Supply	15.45	12,000
Los Angeles, Cal. (shops)	City Supply	15.79	416,000
Niland, Cal.	Colo. River	25.01	130,000
El Centro, Cal.	City Supply	22.91	29,000
Calexico, Cal.	Colo. River	13.93	71,000
Brawley, Cal.	Colo. River	24.84	28,000
Maricopa, Ariz.	Well	15.04	104,000
Mina, Nev.	Well	44.50	30,000
Palisade, Nev.	Springs	11.48	8,000
Yuma, Ariz.	Well	21.87	400,000
Phoenix, Ariz.	City Supply	13.64	104,000
Tucson, Ariz.	Well	7.87	600,000
El Paso, Tex.	Well	14.10	600,000
Wells, Nev.	Well	16.26	310,000
Carlin, Nev.	Spring & Well	14.93	368,000
Taylor, Cal.	Well	22.22	462,000

No trouble has been experienced because of any pitting effect of alkali chlorides remaining in the water treated by zeolite. Pieces of new boiler plate and boiler flues were suspended in the stationary boiler at the West Oakland terminal, which is supplied with zeolite-treated water, and after a period of a year, close examination showed no evidence of corrosion, pitting or scale on the test pieces.

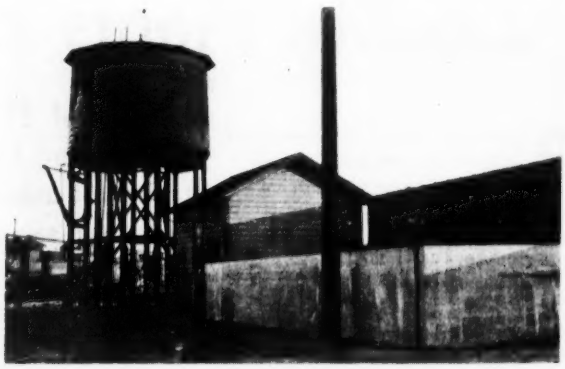
It has been found that water high in alkali chlorides can not be treated successfully by the zeolite method, as such chlorides interfere not only with the softening of the water, but with the regeneration of the zeolite as well. Also, turbid water creates a film over the zeolite sand, minimizing its efficiency, and where such waters are encountered, pre-filters have been installed. For example, filters have been provided in connection with the plants a Brawley, Niland and Calexico, Cal., which are supplied by the Colorado and Gila rivers, and at the plant at Yuma, Ariz., where the water is obtained from wells which derive their supplies from the underground flow of these rivers.

One of the outstanding demonstrated advantages of the zeolite plants on the Southern Pacific has been their economy of operation. Detailed records of operating costs show that the cost of treating water over the system averages $0.0381 per thousand gallons, with variations caused primarily by the quantity and quality of the water treated. The above average figure includes interest on the investment, depreciation, and the cost of the salt required for regenerating the mineral. The cost of labor at the plants is also included, although in only a few cases have the plants necessitated a payroll increase, the pumper or power plant engineer at the site of the treating plants generally having ample time for the simple extra work required in connection with the treating operations.

Large Savings Being Effected

As a result of the use of the zeolite method, the Southern Pacific is effecting large economies in boiler maintenance and repair. In arriving at these economies, it estimates a saving in boiler maintenance and repair of $0.10 per lb. of scale-forming minerals removed, without taking into consideration the large but indeterminate losses and costs of traffic interruptions due to engine failures resulting from leaky flues.

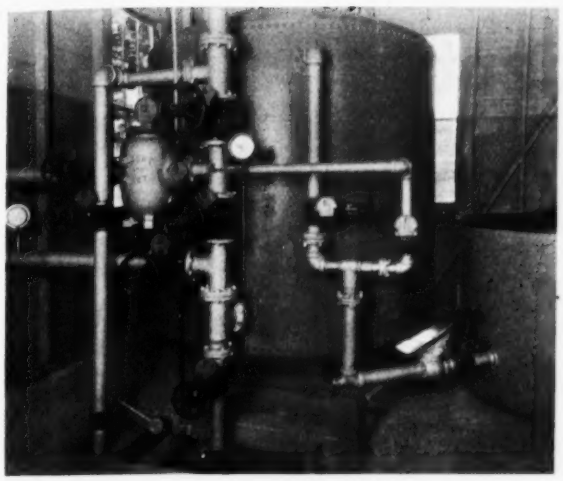
In the 31 plants in operation on the Pacific lines, the raw water contains an average of 18.61 grains of incrustating solids per gallon, which is reduced to an average of 2.6 grains per gallon by treatment. Most, if not all, of the small residue of incrustating solids left in the water will not form scale in the absence of a binder. On the basis of a saving of $0.10 per lb. of scale-forming minerals removed, the average annual saving at each plant is over $19,000; more than double the average initial cost of installation.



One of the Zeolite Plants at West Oakland Cal., Showing the Large Concrete Tank Provided for the Carload Delivery and Storage of Salt for Regenerating Purposes

Up to 1928, with only 16 plants in operation on the Southern district, an actual annual saving of $270,000 was made in labor costs of locomotive maintenance and repairs. Furthermore, it is estimated that the saving in materials used in locomotive repairs was probably equal to 40 to 50 per cent of that for labor. On the basis of a saving of 45 per cent in material, this resulted in a total saving of $391,500 in labor and materials on an investment in the 16 plants of only $139,883. Large as this saving is, it does not include the saving in the cost of fuel.

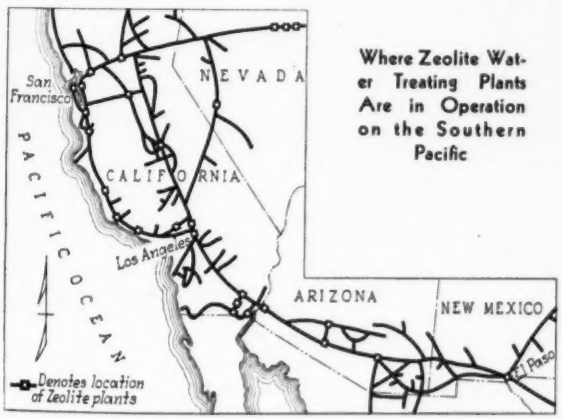
More definite evidence of the savings being effected is evinced by the fact that before the establishment of the zeolite plants, every freight locomotive leaving Los Angeles for San Luis Obispo, Cal., 228 miles, had to be cut out at Santa Barbara, 109 miles distant, for washing out, work on the flues, etc., whereas since the in-



Interior of the Pump House at Davis, Cal., Showing the Vertical Type Zeolite Plant of 4,200-Gal. Per Hour Capacity, Installed at that Point

stallation of the softeners, these locomotives go all the way to San Luis Obispo and return to Los Angeles, 456 miles, without trouble or boiler work of any kind. This has made it possible to do away with the operation of stationary boilers at Santa Barbara and likewise with boiler washers, helpers, etc. at that point.

Passenger locomotives now operate from Los Angeles to San Francisco and return, and then make a round trip to Bakersfield, Cal., 1,294 miles, between boiler washings, and with no boiler work, as compared with the old condition where locomotive boilers had to be washed and repaired to some extent four times on the run from Los Angeles to San Francisco and return, first at San Luis Obispo then at San Francisco, again at San Luis Obispo and then at Los Angeles. In those days no attempt was made to make the additional run



Where Zeolite Water Treating Plants Are in Operation on the Southern Pacific

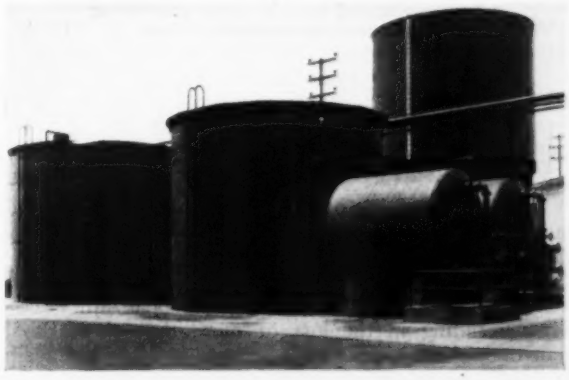
to Bakersfield. At the present time, in the 1,294-mile run from Los Angeles to San Francisco and return and then to Bakersfield and return, boiler washing and other work are done only at Los Angeles.

Prior to the installation of the zeolite plant at Tucson, Ariz., it was necessary to wash and shop switch engines at that point every seven days, doing a certain amount of boiler work. Eight months after new flues were applied, it was usually necessary to renew from one to three flues due to pitting and corrosion in order to keep the full set of flues in service for a total period of ten months, which, at that time was considered a good term of service for the flues. When the flues were removed after this period of service, they generally carried scale to the thickness of approximately ¼ in.

Since the installation of the zeolite plant at Tucson, wash-out periods in the switch engines have been extended to 12 days and boiler and fire-box work have been eliminated, with the exception of the cleaning of fire pans and renewing brick work. After a year's service with new flues, a flue was removed from one of the switch engines for observation, and it was found to be free from scale, pitting and corrosion. From the observations made, it is believed that the lawful limit of service of four years for flues will be realized in the flues in switch engines at this point. It is said that the net saving at this station for yard engine and stationary boiler repairs alone was sufficient in one year to off-set the entire cost of the zeolite plant, without taking into consideration the savings in repairs to road engines.

Savings Made at Laundry

The savings made by water softening on the Southern Pacific have not been confined entirely to locomotive water stations. At the West Oakland laundry of the road, where a zeolite plant was installed in 1924, it has been found that large economies are being effected in the amount of soap required and in the repair and replacement costs of linen. Statistics on the operation of the laundry show that between 1923 and 1928 there was a reduction of $0.0453 in the cost of soap per 100 pieces of linen washed, and a reduction of $0.1315



The Double-Unit, Horizontal Type Zeolite Water Softener Installed This Year at Taylor Yard, Los Angeles, Cal.—Capacity, 33,000 Gal. Per Hour

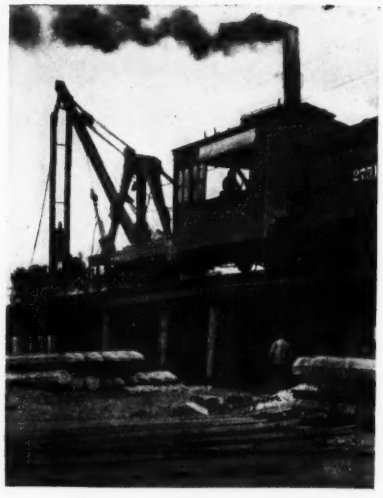
in the cost of repair work per 100 pieces washed. On the 13,000,000 pieces washed in 1928, this represented a saving of $23,000.

It has been found also that the replacement costs of linen are considerably lower since the installation of the zeolite plant, as the soft water reduces the wear and tear on the linen as well as giving the finished laundry a softer and more pleasing appearance.

Convinced of the savings being effected through the present zeolite installations, five additional plants are included in the Southern Pacific's 1931 program of improvements. The ultimate aim is to install plants at all stations where the amount of water used and the degree of hardness will make it possible to effect sufficient savings to justify the cost of the plants.

All of the plants on the Pacific lines have been installed under the direction of W. H. Kirkbride, engineer maintenance of way and structures, and Dennistoun Wood, engineer of tests, of the motive power department.

Eliminating Accidents Among B. & B. Men*



How the P. & L. E. has undertaken to do this through the study of individual cases

By E. W. BOOTS

Engineer Maintenance of Way, Pittsburgh & Lake Erie, Pittsburgh, Pa.

IN 1929, the maintenance of way department of the Pittsburgh & Lake Erie had a casualty ratio of 1.41 per million man-hours. This was the lowest of any of the American railroads. The bridge and building department, as a part of the maintenance of way department, contributed to this low ratio.

The casualty record of the bridge and building department for the years 1924 to September, 1930, inclusive was as follows:

Year	Accidents causing personal injury resulting in loss of more than three days' time	Ratio
1924	10	26.87
1925	12	26.21
1926	3	6.52
1927	1	2.09
1928	0	0.00
1929	0	0.00
1930	0 (First nine months)	0.00

It was the opinion of the officers of the bridge and building department in 1924 and 1925 that the casualty ratio was as low as could reasonably be expected because of the efforts made prior to 1924 to reduce the number of accidents. However, the personal injury accidents resulting in the loss of more than three days' time or in death were greatly reduced in 1926 and again in 1927. In December, 1925, a study of the accidents that occurred in the bridge and building department in 1924 and 1925 was made by the officers of that department and served to convince them that a greater reduction in accidents could be made. The facts as revealed by this study of the accidents are given below briefly.

While ties were being renewed on a bridge, the rails were raised and temporarily supported on blocking. A tie, when being placed in position, struck one of the lines of rails and pushed it off the blocking, injuring the foot of a carpenter. The blocking was too short and the foreman was at fault for not providing blocking of proper length.

In another case when ties were being renewed on a bridge, a carpenter had a thumb lacerated when it was caught between a rail and a tie. The fault was the foreman's in not requiring the carpenter to use a rope sling on the front end of the tie.

Wood forms were being removed from the under side of an overhead concrete structure. A mason helper was prying with a bar and when the form was released he lost his balance and took a step backward. He tripped over a loose 12-in. square timber laying on the ground and fell, fracturing two ribs. The fault was that of the foreman in failing to have the ground cleared for safe working conditions.

A Defective Scaffold

A carpenter was working on a timber scaffold in the interior of the hopper of a fuel station. Some of the planks in the floor of the scaffold extended considerably beyond the supporting joists. The carpenter stepped out to the end of the planks which tipped, causing him to slide down to the bottom of the hopper and to fracture two ribs. The fault was that of the foreman in failing to place the supporting joists properly.

Rails were being driven as piles by a steam hammer on a pile driver. While it was being hoisted into position in the guides, a rail swung about, striking a carpenter and fracturing his jaw. The fault was the foreman's in failing to provide proper means of controlling the rail while placing it in the guides.

The deck plates of a track scale were being renewed. A carpenter had one finger slightly lacerated when it was caught between a cast iron stand and a steel plate being placed in position. The carpenter continued working and did not have the wound examined and dressed. Seven days after the accident, infection appeared in the finger and the carpenter was taken to a surgeon, thereby being off duty seven additional days. The fault was that of the foreman for failing to send the carpenter to a surgeon, as proper dressing of the finger would have prevented the loss of time.

A carpenter was ripping planks on a power rip saw when a strip of wood lacerated one finger. He continued working and did not go to a surgeon. Later the finger became infected and he had to cease working for 12 days. The fault was that of the foreman in failing to send the carpenter to a surgeon.

A ditcher fireman broke a bone in the thumb of his left hand when the wrench he was using slipped off a nut and struck his thumb. The fault was that of the ditcher engineer in allowing the fireman to use a wrench that was too large to fit the nut properly.

A painter, while standing on a scaffold, attempted to reach beyond the limits of the scaffold and fell off, injuring his right arm. The fault was the foreman's for failing to direct the painters to move the scaffold so that the painter could work without reaching beyond the end of the scaffold.

* Abstract of a paper presented before the Steam Railroad Section of the National Safety Congress at Pittsburgh, Pa.

Two carpenters, carrying a joist 2 in. by 12 in. by 22 ft., were ascending two ladders approximately 22 ft. apart. One of the carpenters lost his balance and fell 10 ft., injuring his right ankle. The fault was that of the foreman for permitting the joist to be handled in this manner. It should have been handled by slings in the hands of the two carpenters from the top of the structure.

A carpenter was lifting a plank from the ground to the floor of a trestle by using but one rope sling. The plank got out of balance and struck the carpenter, causing his right hand to be injured. The fault was the foreman's for not providing two carpenters and two slings for lifting this plank.

A carpenter was turning a timber 12 in. square, which was in a pile of creosoted timbers, with a cant hook. The timber swung and struck the carpenter, injuring his right leg. The foreman was at fault for failing to have another carpenter work with this carpenter, each using a cant hook to move the timber.

A carpenter was placing joists on the ground floor of a building and a stringer which he was lifting swung out of position, injuring his back. The foreman was at fault in failing to provide two carpenters to place these joists.

A mason helper was placing a 3-in. by 10-in. by 16-ft. plank in place, when it swung about, striking and injuring his foot. The foreman was at fault in failing to have two mason helpers handle the plank.

A locomotive crane operator was changing a hoisting cable on a clam-shell bucket which he had not placed evenly on the floor of a gondola car. The bucket tipped and squeezed him between the side of the bucket and the side of the car. The foreman was at fault in failing to see that the bucket was standing in a tilted position.

A carpenter was dragging a bridge tie along the top of a rail by using a pair of tie tongs. The tie tilted and the tongs were released, causing the tie to fall on the left foot of the carpenter. The foreman was at fault in failing to provide another carpenter with a pair of tongs so that the tie could have been handled by a carpenter at each end.

Results of the Study

This study showed that 14 of the accidents could have been prevented by the foremen and that two of the accidents were minor ones that would not have involved loss of time if the foremen had complied with instructions to have any minor injury attended to by a surgeon. It also showed that six of the accidents were the result of carelessness on the part of the mechanics injured.

The officers of the bridge and building department renewed their efforts to reduce accidents by calling the attention of the foremen to what could have been done, and the foremen in turn discussed the matter with their mechanics. Immediately a decided improvement took place to the extent that not an accident occurred during the first six months of 1926. However, on July 10, 1926, a foreman left his gang of carpenters for the purpose of making a bill of material. During his absence a carpenter was injured when he jumped from a ladder that had been placed insecurely. The foreman should have made his bill of material where his carpenters were working and if he had done so, he would have observed the insecure placing of the ladder and would have corrected it.

On July 14, 1926, a foreman attempted to move a scaffold along the side of a building with the help of three carpenters. The work required the help of four carpenters. The foreman had other carpenters working on this building but did not call for additional help. A plank in the floor of the scaffold fell and struck one of the carpenters, injuring his ankle. The foreman was wholly at fault. Both of the last mentioned accidents were avoidable.

Immediate Warning is Effective

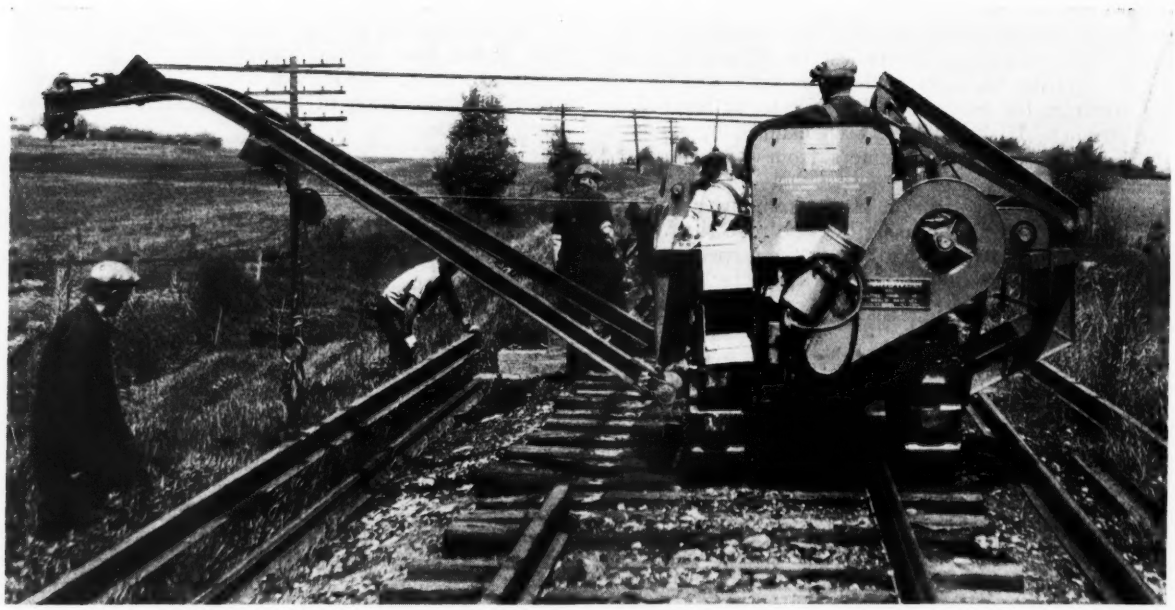
These two accidents were explained immediately to all employees, not only in the bridge and building department but also to all others in the maintenance of way department. There has not been an accident since in the bridge and building department in which a foreman has been at fault.

On October 19, 1926, the roof above the rafters of a roundhouse was being renewed. Sufficient walks for the safety of the workmen were provided, but a carpenter stepped from a walk and fell, breaking his leg. On July 1, 1927, a carpenter, with the assistance of another carpenter, was placing awnings on a building. He had two ladders of different lengths suitable for placing different awnings. He placed the longer ladder on a flat slope, but was cautioned by the other carpenter that the ladder would probably slip. The carpenter paid no attention to this advice and mounted the ladder, which slipped, causing the carpenter to be injured. Both of the accidents were also immediately explained to all employees in the maintenance of way department.

The result has been that there were no accidents in the bridge and building department from that date to the end of the period covered in this paper which was 39 months. The efforts of the foremen and other supervisory officers have been an incentive to the mechanics to take proper precautions and the result is that the accidents that mechanics were having have been eliminated to a considerable extent by the efforts of the mechanics. The character of the work performed has been the same through the entire period from 1924 to 1930, inclusive.

Foremen and other supervisory officers, by constant attention to the work of the employees under their supervision, can prevent all accidents with very few exceptions. The descending casualty ratio of the bridge and building department is the result of making safety a part of the work and of constantly practicing safe methods. There has been no accident causing a fatality or permanent maiming in the bridge and building department of the P. & L. E. since December 5, 1923.

At the Hoosac Tunnel on the Boston & Maine



Laying Rail With a Caterpillar Tractor

New Uses Indicate Broader Field for Tractors

Adaptability of this equipment to maintenance-of-way work is demonstrated in rail laying and other operations

FURTHER diversification of the use of tractors in railway maintenance work is indicated by the considerable number of new and unrelated operations in which they have been employed of late. Some of the more important of these uses include the laying of rail, the cleaning of large culverts, the dismantling and loading of retired track, the stringing of telegraph and signal wires, the breaking of concrete and the drilling of wells through the use of an air compressor attached to the tractor. In addition, this equipment has been used extensively in ditching and grading work, on construction projects and for other purposes.

The Tractor in Rail Laying

A number of these operations are of such recent development that standard practices and methods have not been worked out and the methods used are still in the experimental stage. Among these is the laying of rail, which had its inception on the Chicago Great Western during the present season, when, using a Caterpillar tractor, a total of about nine track miles of rail was laid in single-track territory, half of this near Pearl City, Ill., and the other half between Elmhurst, Ill., and Lombard. The following description of the methods applies to the operations between Elmhurst and Lombard, although the equipment used and the organization of the gang at Pearl City were substantially similar.

The rail laying unit consisted of a Model 20 Caterpillar tractor equipped with a Cardwell boom. The gang was composed of about 55 men and the organization did not differ greatly from that of a gang of the same size using other rail-laying equipment. Other power equipment employed on this project consisted of a Nordberg spike puller and two Nordberg adzing machines. In this work, 33-ft. 85-lb. A. S. C. E. rail was relaid with 39-ft., 110-lb. R. E. rail. Except on curves and through highway crossings and switches this track is not tie plated.

The Cardwell boom is a side boom that was developed originally for use with the Caterpillar tractor in connection with the placing of pipe lines. It has a total length of 13 ft. and is capable of lifting a load of 2,000 lb. at a 12-ft. radius and 6,000 lb. at a 4-ft. radius, which loads may be increased considerably by the use of counterweights on the machine. Because of the unnecessary length of the boom the fall line was reeved through an auxiliary sheave located at about its center. When in position for laying rail, the tractor straddles one line of rails and moves back and forth in this position while laying rails on the other side of the track. When closing the track for approaching trains, the tractor climbs the rail to the shoulder of the embankment or some other convenient point on the right of way, and at night it is left at the site of the work.

Proceeding backward from the front, the rail-laying

organization consisted of a flagman, two men oiling the joint bars which are hung on the rear ends of the rails with one bolt; two men with adzes cutting around spikes to facilitate spike pulling; three men operating the Nordberg spike puller; three men pulling spikes left by the machine—two men with claw bars and one with a maul; four men throwing out the old rail; one man setting tie plugs, another driving them down and a third cutting them off with an adze; five men cleaning ballast from between the ties, including one with a pick, two with shovels, another with a broom sweeping off the ties and a fifth with a spike maul driving down protruding spikes; the two adzing machines, each operated by one man; the tractor with an operator, one man at each end of the rail and one handling the rail tongs; two men with a push car distributing spikes, anti-creepers and bolts; one man with a track gage and two with spike mauls gaging track; four men driving spikes; three men placing bolts; two men placing anti-creepers; and two spotting up low ties. In addition, the gang was followed by a welder and helper and two signalmen placing bonding wires. The remainder of the gang was composed of a foreman, an assistant foreman, a time keeper, a water boy and one man grinding tools.

With this organization it was not possible to complete the work entirely as the gang progressed, and at times when the track was cleared to allow the passage of trains or late in the afternoon, the entire force was sent back to finish the spiking and bolting. It was evident that the force was not sufficiently large to permit of the tractor being utilized to capacity, and as a consequence this machine was idle during a considerable part of the time, while some other phase of the work was being brought up to it. It is estimated that a larger force and additional power equipment would be necessary to require the operation of the tractor to capacity.

The timing of these operations showed that at one time 47 rails were laid in one hour and that the complete operation of handling one rail into the track may be accomplished in about 50 sec.

During this work the tractor was called upon to perform a number of duties that were more or less incidental to the rail-laying operation. These included the switching of cars, the unloading of frogs and other material and the dragging of various lengths of rail into or out of the track at highway crossings. With reference to the latter operation, the old 85-lb. rail, in lengths averaging four rails, was dragged out by the tractor and replaced by three 110-lb. rails welded together. As is to be expected there is considerable opportunity for improvement with regard to the rail-laying operation and it is thought that, after a certain amount of adjustment, the organization may be perfected to a point where the output will considerably exceed that obtained heretofore.

Its Use on the Pennsylvania

Another task in which a tractor was utilized to advantage was the cleaning of a large concrete culvert on the Pennsylvania, where a sizable reduction was effected in the cost of doing this work as compared with what it had cost in the past when other methods were used. The culvert, which is of concrete arch construction, carries a stream under a railroad yard and has a maximum height of 7½ ft., a width of 16 ft., and a length of 432 ft. The culvert had become filled with debris to a depth of from 22 to 24 in., and it was decided to clear it of this material by using a Caterpillar Model 10 tractor with a Sidney shovel of ½ cu. yd. capacity. The latter

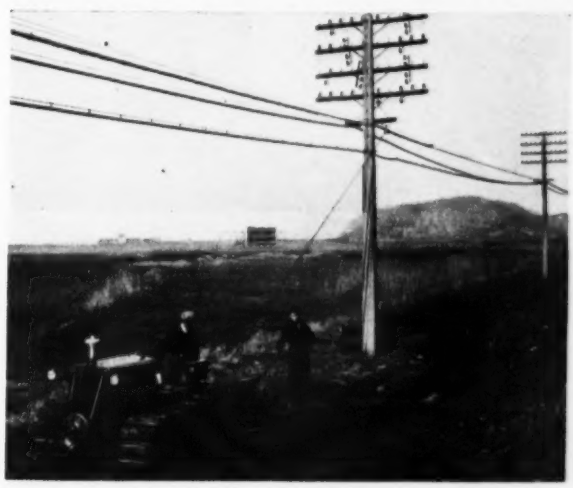
A Large Saving Was Effected by Utilizing a Tractor in the Cleaning of this Culvert

piece of equipment, which is similar to an ordinary slip scraper except that it is larger and heavier in construction, was chosen for this work because it appeared best adapted to the limited clearance afforded by the culvert. The scraper was attached to the tractor by means of a chain hitch 5 ft. in length in order to permit the outfit to make short turns within the tunnel.

The material from the culvert was hauled about 375 ft. by the tractor and deposited along the toe of the railway embankment. In addition to the operation of cleaning the tunnel, the tractor and scraper were utilized to cut a channel from the downstream end of the culvert to the Allegheny river, a distance of 75 ft. A total of 616 cu. yd. of material was moved on this job at a cost, including labor, rental of equipment and fuel, of $625, or $1.01 a yard. The project was completed in 22 working days, during which the average day consisted of 6½ hr. after deducting the time consumed by the crew in getting to and from the job. As compared with the cost of doing this work several years ago, when it required 8 men working 6 weeks to complete a job at a total cost of $6,000, or about $10.60 a yard, the saving effected by the use of the tractor and scraper was nearly $9.60 a yard.

Stringing Wire

The Pennsylvania is employing extensively at least two additional tractors, one a Model 15 equipped with a Willamette Single-Drum Hyster winch and a Barton pump, and the other a Model 60, equipped with a La Plant-Choate bulldozer. The former was fitted especially for the stringing of telegraph and signal wires in connection with the electrification project of the Pennsyl-



An Average of 1½ Miles of Wire Was Strung Daily

vania between New York City and Philadelphia, Pa. Crawler equipment was desirable for this work because the pole line was situated in soft and somewhat swampy ground on which the tracks are carried on an earth fill.

In this work the tractor is manned by an operator and two helpers. The tractor is placed about 600 ft. ahead of the end of the wire and then by means of a ⅜-in. cable wound on the winch, pulls the wire up to the tractor. Occasionally, where the ground is unbroken and where there are no obstructions, the wire is pulled out by a straight drawbar pull, but this is not often the case. In an 8-hr. day, in which only about 5½ hr. were spent actually stringing wire, it was said that an average of 1½ miles of wire has been strung out. The cost of operating the tractor, including all items, is estimated at $25.76 for an 8-hr. day. Using man-power, it is estimated that about 20 men, at a cost of $93.92 a day, would be required to replace the tractor, thus indicating a saving of $68.16 a day through its use.

One of the operations for which the Model 60 equipped with a bulldozer was used was to collect into piles the ballast on an old roadbed so that it could be conveniently screened and loaded. In this work, the tractor, manned by an operator and a helper, was operated at an estimated cost of $30.24 a day. Estimates showed that from 40 to 50 men, at a cost of $191.36 a day would be required to accomplish the same amount of work.

On the Nickel Plate

A Model 20 tractor equipped with a Cardwell boom hoist, such as that used in the rail-laying operations, was put to an unusual use on the New York, Chicago & St. Louis (Nickel Plate) recently when it was used extensively in connection with the taking up of 5,886 ft. of main and side tracks. In this work, which was carried out at East Peoria, Ill., all work involved in retiring 3,881 ft. of main track and 2,005 ft. of side track was done at a cost of $332.65 for the former and $135.23 for the latter. It was estimated that these figures represented a saving of about 50 per cent as compared with the probable cost of doing this work by the usual methods.

At Peoria Loading Material From the Retired Tracks

In connection with the retiring of the main track, the tractor took up and loaded into cars 7,763 lin. ft. of 80-lb. rail, 129 ft. of 75-lb. rail, 286 ft. of 56-lb. rail, 1,927 crossties, 50 pieces of 3-in. by 8-in. by 16-ft. oak plank, 3 toilets, 3 coal boxes, 1 flagman's shanty, 2 concrete whistling posts and the track fastenings. During the work of taking up the side track, the tractor loaded 814 ft. of 80-lb. rail, 3,196 ft. of 56-lb. rail, 2 complete 80-lb. turnouts including the ties, 548 crossties and the track fastenings. All switching that was necessary in connection with the handling and loading of 17 cars was done by the tractor.

The Atchison, Topeka & Santa Fe had used a Model 20 tractor equipped with a Davey air compressor for a number of purposes, including the breaking up of concrete, the drilling of holes in concrete, the caulking of joints in drainage pipe lines and the pumping of sand from well caissons as they were being sunk. With reference to the first named operation, the tractor and compressor were used to remove the concrete bottom of an old water-treating tank, 25 ft. in diameter, which contained about 136 cu. yd. of concrete and had a maximum thickness of 3 ft. Two jack hammers, each requiring an operator, were employed to break the concrete, which was removed through a hole in the tank by two other men. The work of breaking up and removing the concrete was completed in 6½ days at a cost of about $205. If this work had been done by hand, it was estimated that it would have required 12 men 12 days at a cost of about $606 to complete the job. Estimates of the cost of doing the various types of work mentioned above with the tractor-compressor unit showed comparable savings.

Wood Preservation Holds Its Own in 1930

IT IS of special interest that only slight decreases were shown in the quantity of wood treated and of preservatives used in the United States in 1930, as compared with the record year of 1929. It is also an important fact that the figures for this year have been exceeded in only 3 of the 22 years that these records have been kept. Compared with the peak year of 1929, the total quantity of wood treated in 1930, which was 332,318,577 cu. ft., showed a decline of only 29,680,470 cu. ft., or eight per cent. Furthermore, this volume is only 3,601,802 cu. ft., or one per cent less than in 1928. All but 10 per cent of this material was given pressure treatment.

Greatest Part Is Cross and Switch Ties

Crossties and switch ties continued to constitute the bulk of the wood given preservative treatment, the combined totals of these two products being 204,424,034 cu. ft. or 62 per cent of the entire volume. Of this total, crossties comprised 189,801,321 cu. ft., a decrease of 23,267,988 cu. ft. from the previous year. The number of cubic feet of switch ties treated, 14,622,713 cu. ft.,

Statement of Material Treated by Classes (Cu. Ft.)

Class	1930	1929	Increase or Decrease
Crossties	189,801,321	213,069,309	—23,267,988
Switch ties	14,622,713	14,425,642	+197,071
Piles	17,027,153	17,126,794	—99,641
Poles	75,258,146	77,154,317	—1,896,171
Wood blocks	5,012,445	6,852,130	—1,839,685
Crossarms	1,299,246	1,957,431	—658,185
Construction timbers	19,013,369	20,203,811	—1,190,442
Miscellaneous Materials	10,284,184	11,219,613	—935,429

showed an increase of 197,071 cu. ft. It is a matter of special interest, however, that whereas the total number of poles treated, 4,276,031, was about 2.5 per cent less than in 1929, the number of southern pine poles increased to 2,428,173 or by 21 per cent, making the fourth consecutive year that the number of poles of this species exceeded the combined total of all other species that were treated.

These outstanding facts, together with the other figures given, are taken from the twenty-second annual statistical report on wood preservation in the United States for 1930, prepared by E. K. Helphenstine, Jr., forest service, United States Department of Agriculture, in co-operation with the American Wood-Preservers' Association.

Treatment of Miscellaneous Materials (Ft. B. M.)

	1930	1929	1928
Lumber	76,244,055	87,972,030	64,426,979
Fence posts	17,843,001	10,904,180	7,272,422
Tie plugs	1,779,215	2,018,147	1,747,026
Car material	753,440	942,243	542,024
Crossing plank	2,552,370	273,588	1,460,463

A total of 204 treating plants were in active operation, or one more than in 1929, while 11 were idle. Four new plants were constructed during the year, three less than in the previous year. Of the active plants, 134 were of the pressure-cylinder type, 53 were non-pressure (open tank) plants, while 17 were equipped for both pressure and non-pressure treatment.

Creosote continued to be the most widely used preservative, although 49 per cent more miscellaneous salts and more than five times the quantity of miscellaneous liquids were reported than in 1929. The consumption of creosote dropped 5.5 per cent, to 213,904,421 gal. of which 145,595,733 gal., or 68 per cent was produced in this country, making 1930 a record year for the consumption of domestic creosote.

Wood Preservation, 1909-1930
Together with consumption of creosote and zinc chloride

Year	Total Material Treated, Cu. Ft.	Number of Crossties Treated	Creosote Used, Gal.	Zinc Chloride Used, Lb.
1909	75,946,419	20,693,012	51,426,212	16,215,107
1910	100,074,144	26,155,677	63,266,271	16,802,532
1911	111,524,563	28,394,140	73,027,335	16,359,797
1912	125,931,056	32,394,336	83,666,490	20,751,711
1913	153,613,888	40,260,416	108,378,359	26,466,803
1914	159,582,639	43,846,987	79,334,606	27,212,259
1915	140,858,963	37,085,585	80,859,442	33,269,604
1916	150,522,982	37,469,368	90,404,749	26,746,577
1917	137,338,586	33,459,470	75,541,737	26,444,689
1918	122,612,890	30,609,209	52,776,386	31,101,111
1919	146,060,994	37,567,247	65,556,247	43,483,134
1920	173,309,505	44,987,532	68,757,508	49,717,929
1921	201,643,228	55,383,515	76,513,279	51,375,360
1922	166,620,347	41,316,474	86,321,389	29,868,639
1923	224,375,468	53,610,175	127,417,305	28,830,817
1924	268,583,235	62,632,710	157,305,358	33,208,675
1925	274,474,538	62,563,911	167,642,790	26,378,658
1926	289,322,079	62,654,538	185,733,180	24,777,020
1927	345,685,804	74,231,840	219,778,430	22,162,718
1928	335,920,379	70,114,405	220,478,409	23,524,340
1929	362,009,047	71,023,103	226,374,227	19,848,813
1930	332,318,577	63,267,107	213,904,421	13,921,894

Although the quantity of petroleum consumed in wood preservation was 5.2 per cent less than for 1929, the 28,100,316 gal. used for this purpose was larger than for any year of record, except 1929. The consumption of zinc chloride fell off nearly 30 per cent to 13,921,894 lb., owing largely to lessened use of this salt in the treatment of ties, since an increased quantity was used in the treatment of other classes of material. The miscellaneous preservatives consisted of 1,770,925 lb. of salts and 202,891 gal. of liquids. The salts comprised sodium flouride, sodium arsenite, sodium chloride, arsenic trioxide, zinc-meta-arsenite, mercuric chloride, and Wolman salts. The liquids included Ac-zol, montan wax and Carbosota.

While the number of crossties showed a considerable decline from the figures for 1929, the number treated in 1930 has been exceeded only three times in the 22 years covered by the record. Of the total of 63,267,107 crossties reported, which was a decrease of 7,755,996 as compared with 1929, nearly 62 per cent, or 39,059,947 were given treatment with creosote; 16,358,893, or 26 per cent, with creosote-petroleum mixtures; 10 per cent with zinc chloride; and 2 per cent with creosote in mixture with zinc chloride. Of the total ties, 30,009,883 were sawed and 33,257,224 were hewed. Oak ties again ranked first from the standpoint of the number treated, 21,040,750 or 33.3 per cent being of this species.

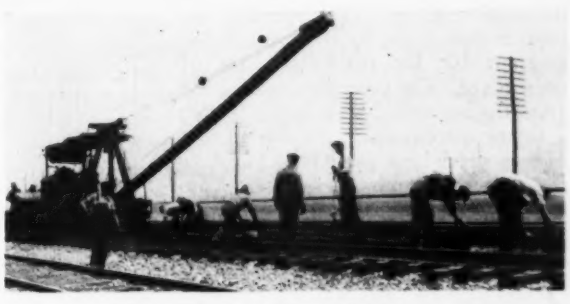
Number of Crossties Treated—By Kinds of Wood and Kinds of Preservatives—1930

	Number of Crossties						
Kind of Wood	Treated with creosote[1]	Treated with creosote-petroleum mixtures[2]	Treated with zinc-creosote mixtures[3]	Treated with zinc chloride	Treated with miscellaneous preservatives	Total	Per cent
Oak	17,465,287	2,227,752	214,000	1,119,600	14,111	21,040,750	33.3
Southern pine	11,621,440	4,584,315	26,454	707,304	3,988	16,943,501	26.8
Gum	4,206,501	1,062,314	92,644	297,435	.....	5,658,894	8.9
Douglas fir	372,312	3,953,956	.....	692,537	39,447	5,058,252	8.0
Lodgepole pine	739,444	1,238,847	103,626	750,908	5,451	2,838,276	4.5
Maple	1,364,062	518,935	53,500	565,899	.....	2,502,396	4.0
Beech	1,709,058	204,520	107,000	469,938	.....	2,490,516	4.0
Western yellow pine	5,998	1,556,304	587,220	63,007	768	2,213,297	3.5
Birch	696,974	506,928	53,500	407,856	.....	1,665,258	2.6
Tamarack	57,000	246,952	26,750	895,176	2,700	1,228,578	1.9
Hemlock	.....	790	.....	385,339	.....	386,129	0.6
Elm	160,886	28,047	.....	17,612	.....	206,545	0.3
Miscellaneous	660,985	229,233	80,252	53,718	10,527	1,034,715	1.6
Total	39,059,947[4]	16,358,893	1,344,946	6,426,329[5]	76,992	63,267,107	
Per cent of total	61.7	25.9	2.1	10.2	0.1		100.0

[1]Includes distillate coal-tar creosote, creosote coal-tar solution, refined water-gas tar and water gas tar solution.
[2]Includes distillate coal-tar creosote, creosote coal-tar solution, refined water-gas tar and water-gas tar solution in mixture with petroleum.
[3]Includes distillate coal-tar creosote, creosote coal-tar solution, refined water-gas tar and water-gas tar solution in mixture with zinc chloride.
[4]Includes 55,978 crossties treated with creosote in mixture with sodium chloride.
[5]Includes 146,871 crossties that were given an additional treatment with petroleum.

Southern pine came next with 16,943,501, or 27 per cent, while gum with 5,658,894 and Douglas fir with 5,058,252 were third and fourth respectively. These four species represent 77 per cent of all crossties treated in 1930. Next in order were lodgepole pine, maple, beech, western yellow pine, birch, tamarack, hemlock and elm. The steam railways consumed 62,242,640 of these ties, while 1,024,467 were used by electric lines.

The table of selected items taken from the tabulation of miscllaneous materials shows large increases in all materials as compared with 1928. It also shows large increases in fence posts and crossing planks as compared with 1929 and relatively small decreases in other materials.



Laying Rail on the Pennsylvania Near Ben Avon, Pa.

Diagrams Used for Speed Tests

AS A MEANS of ascertaining the approximate speed of passenger and freight trains by observation from the ground, the Nashville, Chattanooga & St. Louis has incorporated in its book of rules and instructions for maintenance of way employees two simple diagrams, one of which is for use when determining the speed of freight trains and the other when determining the speed of passenger trains. By the correct use of the appropriate diagram and an ordinary watch or stop-watch, one or two observers standing on the ground beside the track may determine the speed of a passing train in miles per hour with a degree of accuracy sufficient for all practical purposes.

The general character of the diagrams as well as their method of use are similar. Each consists essentially of a horizontal scale representing the number of cars passing a given point, a vertical scale representing the speed of the train in miles per hour and a number of diagonal lines representing the time in seconds required for a certain number of cars to pass a given point. The calculations for Diagram No. 1, which is used to determine the speed of ordinary freight trains, are based on 43-ft. as being the average length of each car and the engine and tender together are assumed to represent two cars, while for Diagram No. 2, which is for passenger trains, the average length of the coaches is taken as 80 ft. and the engine and tender together are counted as one 80-ft. coach.

The instructions for procedure, which the diagrams, state that, when determining the speed of trains, best results may be obtained by an observer equipped with a stop-watch for timing. However, in the absence of a stop-watch and when two observers are available, the instructions recommend that one of them record the time in seconds consumed by the train in passing a given point while the other counts the number of cars. The speed of the train is then found by reference to the diagram for the particular class of train noted. The procedure is to select from the horizontal scale at the bottom a figure corresponding to the number of cars which have passed and to follow the vertical line upward to where it intersects with the diagonal line showing the number of seconds consumed by the train in passing. From this point, a horizontal line is followed to the edge of the diagram where the speed of the

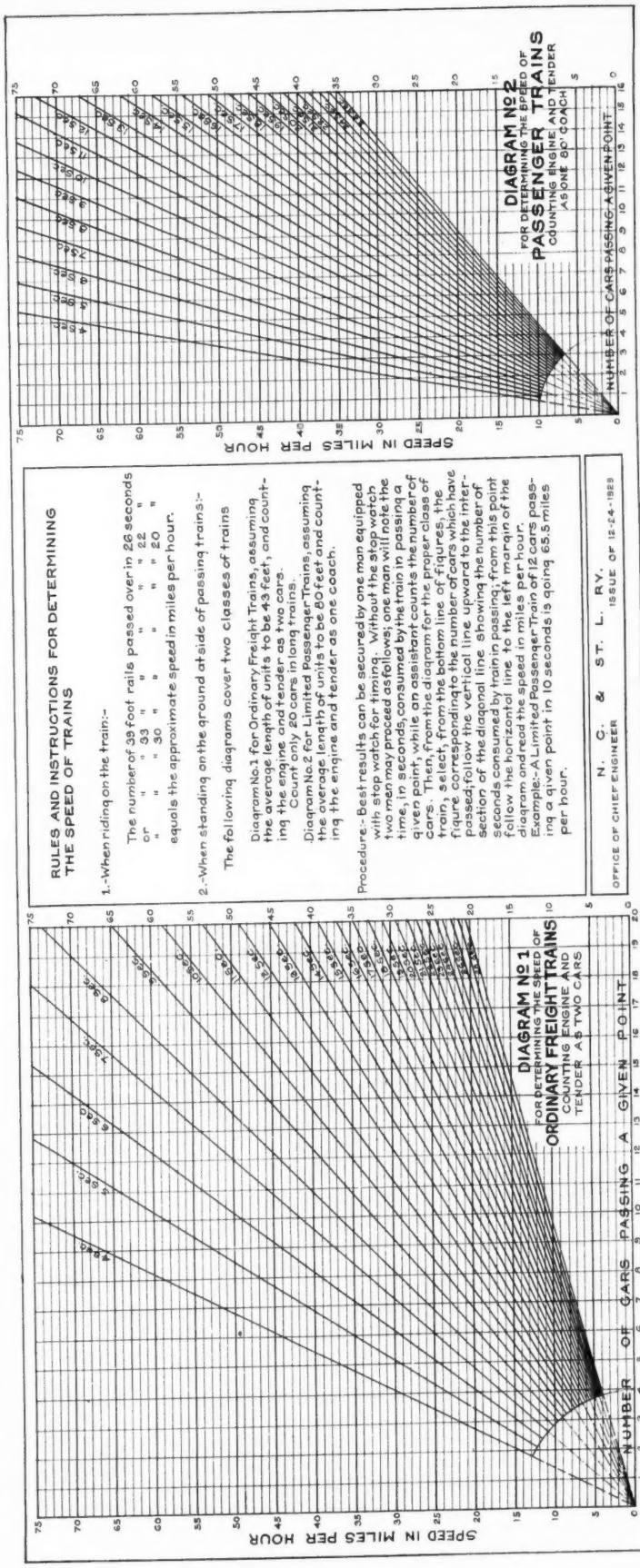


DIAGRAM No 2
FOR DETERMINING THE SPEED OF
PASSENGER TRAINS
COUNTING ENGINE AND TENDER
AS ONE 80' COACH
NUMBER OF CARS PASSING A GIVEN POINT
SPEED IN MILES PER HOUR
RULES AND INSTRUCTIONS FOR DETERMINING THE SPEED OF TRAINS
1.-When riding on the train:-
The number of 39 foot rails passed over in 26 seconds
or " " 33 " " " 22 " "
" " " 30 " " " 20 "
equals the approximate speed in miles per hour.
2.-When standing on the ground at side of passing train:-
The following diagrams cover two classes of trains
Diagram No.1 for Ordinary Freight Trains, assuming the average length of units to be 43 feet, and counting the engine and tender as two cars.
Count only 20 cars in long trains.
Diagram No.2 for Limited Passenger Trains, assuming the average length of units to be 80 feet and counting the engine and tender as one coach.
Procedure:- Best results can be secured by one man equipped with stop watch for timing. Without the stop watch two men may proceed as follows; one man will note the time, in seconds, consumed by the train in passing a given point, while an assistant counts the number of cars. Then, from the diagram for the proper class of cars. Then, from the diagram for the proper class of train, select, from the bottom line of figures, the figure corresponding to the number of cars which have passed; follow the vertical line upward to the intersection of the diagonal line showing the number of seconds consumed by train in passing; from this point follow the horizontal line to the left margin of the diagram and read the speed in miles per hour.
Example:- A Limited Passenger Train of 12 cars passing a given point in 10 seconds is going 65.5 miles per hour.
N. C. & ST. L. RY.
OFFICE OF CHIEF ENGINEER ISSUE OF 12-24-1928
DIAGRAM No 1
FOR DETERMINING THE SPEED OF
ORDINARY FREIGHT TRAINS
COUNTING ENGINE AND TENDER AS TWO CARS
NUMBER OF CARS PASSING A GIVEN POINT
SPEED IN MILES PER HOUR

A Reproduction of the Diagram Used by the Nashville, Chattanooga & St. Louis for Determining the Speed of Trains

train in miles per hour is read directly from the figure.

The diagrams are used when investigating violations of speed regulations, and weekly reports containing data on speed tests are caused to be made by the division superintendent. Each report contains a series of observations, each of which consists of the initials of the observer, the date of the observation, the train and engine numbers, the location of the test, the time consumed by the train when passing the observer, the speed of the train in miles per hour, and the excess speed. No disciplinary action is taken unless the excess speed is more than five miles per hour, and then only after a number of warnings have been given and disregarded.

In addition to the diagrams, data are given to enable an observer to ascertain the speed of the train on which he is riding. These data are based on the length of the rails which are passed over, and the observer may determine the speed of the train by recording the number of rails which the train passes over in a given number of seconds. For instance, if the rails in the track are 39 ft. long, the number of these rails passed over in 26 sec. is equal to the approximate speed of the train in miles per hour. Similarly for 33-ft. rails the time is 22 sec. and for 30-ft. rails is 20 sec.

These diagrams and other data were calculated in the office of Hunter McDonald, chief engineer, to whom we are indebted for the information appearing in this article.

What Are the Qualifications of a Section Foreman? *

A FOREMAN is the point of contact between the men and the management, he is, therefore, one of the strongest links in the railway organization. His selection constitutes an important problem, especially for the supervisor, because the success of the supervisor's track maintenance organization depends on the efficiency of his foremen.

The ideal foreman, embodying all the requirements suggested by the different members of the committee, and insisted upon by the various railroads, should have the following qualifications:

1. Age—22 to 45.
2. Physically strong, morally fit.
3. Experienced in track work.
4. At least a grammar school education, and be able to pass an examination on the book of rules.
5. Be able to handle men and direct work.
6. Be careful, and interested in safety.
7. Quick of decision and positive in his opinion.
8. Frank, honest, loyal and obedient.
9. Have political ability.
10. Know how to plan work.

No applicant, of course, will ever have all the foregoing qualifications. If he had, he would be eligible for the position of superintendent instead of foreman. Each of these qualities has a certain weight, however, in determining foremen material, and a man is either "heavy or light" as a foreman, depending on the sum total of his qualifications.

Some of these qualifications can be determined by some form of examination, but the most important ones can be determined only by personal contact and observation. An applicant may have passed the highest test on the book of rules and may have had a grammar school or even a high school education, and yet be a complete failure as a foreman. On the other hand, some of the best foremen can barely read or write.

*A paper presented at the April meeting of the Metropolitan Track Supervisor's Club, New York, by a committee of which E. L. Koch, assistant to division engineer, Pennsylvania, was chairman.

Suggestions on Finding Right Man

How then shall we find the right material for the foreman's job? We should secure him from the ranks, where, by reason of his ability, he has first attracted our attention. Therefore, the consideration of a man for a position as foreman should begin when the man enters the service. The wide-a-wake supervisor and his assistant will recognize in him qualities which, if properly developed, will make foreman material, just as a coach recognizes varsity possibilities in his freshman recruits. These qualities should be developed through the foreman, by giving him odd jobs to do alone or with one or two men as helpers. Foremen must be made to realize that the development of their men is as important as the maintenance of their track, which will be vastly easier with an understanding ambitious gang of men.

If the man in question bears out the opinion of the supervisor by showing fitness and aptitude for service, he should be given more responsibility and told that he is in line for promotion to "first laborer," assistant foreman and foreman. One should exercise great care, therefore, in appointing an assistant foreman, always bearing in mind that he is placing this man in line to become a foreman. Often a man is appointed an assistant foreman on account of his length of service, when it is known that he can never qualify for the foreman's job, and indeed, in many cases, that the man would not accept a foreman's job if it were offered to him. The wise choice of an assistant foreman has a two-fold advantage. The men themselves have the assurance that ability in the ranks will be recognized and not seniority alone, and the company has a good reserve force of men for foremen when needed.

Foreign laborers are usually reluctant and need encouragement to bring out their real ability. A single bit of recognition of work well done is often the spark that fires a man's ambition and starts him up the ladder.

The Qualifications Discussed

Let us consider the qualifications mentioned above:

1. (Age 22 to 45 years). Generally speaking, a man is not able to handle and to command the respect and obedience from other men before he is 22 years of age. On the other hand, if his ability is not recognized before he becomes 45, he is quite likely not foreman timber. There can be no arbitrary rule about age, however, as there are prodigies in all lines of work, while some of the older men have never been given a chance.

2. (Physically strong, morally fit). Track work is work for a robust, steady, alert man, and therefore a strong physique and good morals are decided assets.

3. (Experienced in track work). Obviously, and for that reason he must be selected from the ranks, because the only place to learn track work is on the track.

4. (At least a grammar school education—Able to pass an examination on the Book of Rules). The question of educational requirements for foremen is a debatable one. While it is desirable that a foreman have a grammar school education, we are inclined to believe that too much emphasis is placed on the ability of a section foreman to make good reports; on his hand writing; on his telephone messages, etc. After all, his ability as a track maintainer is the most important consideration,

and we can not insist that too many academic attainments be added to the natural ability that a foreman must have, because the combined attainments would take the man out of a foreman's class. Of course, he should understand the book of rules, the operations of signals, the operation of hand and motor cars, and flagging rules, but he can become familiar with all of these details while he is coming up through the ranks and learning the fundamentals of track maintenance.

5. (Able to handle men and direct work). This is the greatest factor in a foreman's success. A foreman should be able to deal frankly and honorably with his men and to establish correct discipline and organization among them. He should lead rather than drive, and have confidence in himself in order to win the confidence and respect of his men. He must have a complete knowledge of the details of his work and must be able to explain these details to his men; always listening to whatever suggestions or ideas his men may have. Many good trackmen can not handle men and direct work. The step rate system and the use of titled positions in a gang will help the supervisor to eliminate these men, but, if by mistake such a man should be made "first laborer" or assistant foreman, he should be removed from the position when the mistake is discovered.

6. (Be careful, and interested in safety). Waste in any form, whether in capital, labor or service, mounts into money quickly, and the prospective foreman should learn from his foreman, who, in turn, has been instructed by the supervisor at foremen's meetings, concerning the actual cost of new materials, and the salvage value of the materials he is removing. This will cause him to respond to appeals for economy more quickly than by any other method of approach. He will have learned also that conservation of human life and the reduction of accidents, both train and personal injury, save money as well as eliminate suffering.

9. (Have political ability). A foreman should be able to carry out instructions and, at the same time, maintain a friendly attitude towards property owners and shippers along his territory. His political activities will, ordinarily, have a wider range in city districts where he is often the contact man of the company with the local politicians.

10. (Must know how to plan work). Two conditions are fixed; length of seasons and length of subdivisions. Therefore, on account of the natural interruptions in track work due to weather conditions, wrecks, cuts in expenditures for material and labor, etc., it is necessary for a foreman to plan ahead in order to cover his work in the allotted time.

Must Love His Work

A qualification not mentioned, and yet, one without which all the others would be of no avail, is the ability of a man to learn to love work. No man can succeed unless he learns how to love the job he has in hand. The efficiency of a man is either raised or lowered by his mental attitude toward his company and toward the foreman under whom he works. Therefore, the wise foreman will learn how to make his men like their work and be loyal to their company. To this end, he will become familiar with the peculiarities and the make-up of every man in his gang. His ability to spread good will and respect among his men will bring greater results than his ability to drive them for a certain number of hours each day.

In conclusion, the rock-bottom qualifications for success as a foreman are: Experience in track work, ability to handle men, and love of his work. The selection of the right men for foremen depends on the discovery of these qualifications in their men by foremen and supervisors, which can be made only through personal contact and observation.

Use of Ready Mixed Concrete Saves $4 per Yard

A SAVING of at least $1,200 was made recently by the Chicago, Burlington & Quincy in providing 300 cu. yd. of concrete for a job at Minneapolis, Minn., by buying ready-mixed concrete rather than mixing the concrete at the site. This concrete was required for the floor and roadways of a new fruit house at North Seventh street and Hoag avenue. This is a steel-frame, industrial-type structure, 200 ft. long by 90 ft. wide, affording a clear headroom of 22 ft. under the roof trusses, and the only concrete involved was that required for the foundation piers, floors and roadway pavement.

The Burlington has always done a large part of its concrete work with its own forces. However, after taking into account the cost of shipping in the concrete mixer and other equipment required and the camp cars for the gang, as well as the long haul on the aggregates, and the switching charges involved because the fruit house is an off-line facility, it was concluded that these incidental costs would result in an excessive charge per yard against the limited quantity of concrete required. When the estimated cost per yard on this basis was compared with the price at which ready-mixed concrete could be purchased in Minneapolis, delivered at the job, it was found that the latter would be much cheaper than concrete made by company forces, taking into account the labor of placing the concrete after it was delivered. It was concluded also that the same relation would prevail with respect to concrete work done on the job by a contractor.

Accordingly a contract was awarded to the Ready Mixed Concrete Corporation of Minneapolis to furnish 300 cu. yd. of concrete. The specifications called for a 1-2-4 mix, subject to the approval of the railroad's inspection as to consistency. Little form work was required other than wooden bulkheads along the edges of the roadway and for construction joints, so that the labor which the railway had to provide was confined largely to placing the concrete and floating the surface. The few men required for this work were employed locally and the total labor charge amounted to about 25 cents per cu. yd.

The concrete was hauled a distance of about three miles in tank trucks having a capacity of two cubic yards and equipped with a mechanical agitator that was effective in preventing segregation. The inspector kept a close watch on the concrete as it was delivered, telephoning instructions to the mixing plant whenever, in his judgment, the workability or consistency of the concrete should be altered. He also made occasional visits to the plant. As a further check on quality, test cylinders were made at intervals for test. The results obtained were deemed thoroughly satisfactory and it is estimated that the purchase of its ready-mixed concrete resulted in a saving of almost $4 per cubic yard under the circumstances enforced in this case.

We are indebted for the above information to H. G. Dalton, engineer of buildings, Chicago, Burlington & Quincy, under whose direction the work was done.

A Special Rod for Setting String-Line Stakes

By C. H. HIGGINS,
Assistant Division Engineer, Boston & Maine, Dover, N. H.

THE writer has constructed a rod that is designed to facilitate the setting of center stakes for curves which have been computed by the string-lining method.* Its object is to eliminate the process of converting the half-throws of a curve to feet and fractions of feet for the purpose of setting stakes and it is so designed that the half-throw can be transferred immediately to the graduations on the rod and the exact position of the tack on

Showing the Proper Use of the Rod Using a Plumb Bob.

the stake located in relation to the high or governing rail. In other words, it combines the value of the table of half-throws, as published in the July, 1928, issue of *Railway Engineering and Maintenance*, and a ruer appropriately graduated to measure these distances. This rod will set stakes accurately to a distance of 56 in. on either side of the center of the original curve and by this it is seen that stakes can be set for any solution giving a half-throw not greater than plus or minus 280. In computing curves by the string-lining method, the results obtained are in tenths of inches. Thus a half-throw of 280 is equal to 28 in., and gives a full throw of 56 in.

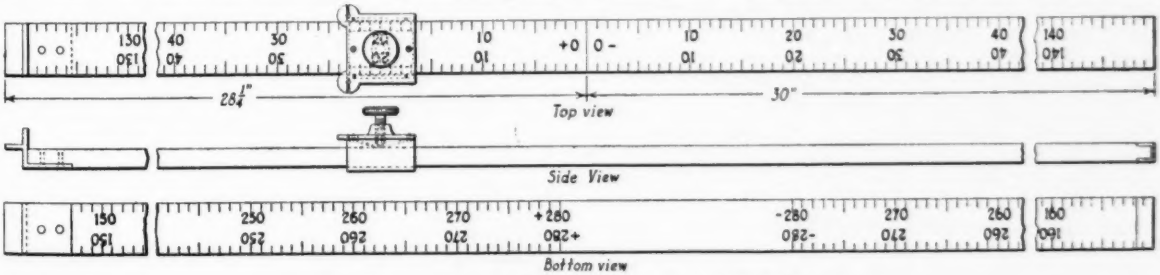
The rod can be made of any kind of wood that has been well seasoned and that will not shrink or warp out of shape. It is 1½ in. wide and ¾ in. thick, with an overall length of 58¼ in., including the brass ferrule on each end.

At the left hand end is a ferrule which combines three functions. The lower vertical face rests against the gage of the high rail, ⅝ in. below the top of the rail, when stakes are being set for half-throws in the range between +141 and —150. It is to be remembered that out-throws are positive and in-throws negative. The horizontal lug is a rest for this end of the rod and, when placed on top of the high rail, it holds the rod from slipping down, thus allowing the operator to grasp the rod at its middle or far end, which will enable him to steady it for making measurements. The top lug is used to hook the gage of the high rail when the rod is turned with the bottom side up and is extending outside the high rail, in order that stakes may be set for half-throws between +141 and +280. On the opposite end is a flat brass ferrule to protect the end of the rod from wear.

The rod is graduated from zero at the middle, which is 28¼ in. or one-half standard gage from the face at the high rail end. From this point, graduations of 0.2 in. are laid off in each direction and on both edges of the rod. It should be understood that the graduations are made 0.2 in. long to convert the half-throw to the full distance. For instance, if the half-throw is 41, or 4.1 in., and a distance of 41 graduations is measured off along the rod, an actual distance of 8.2 in. is laid off, which is the full throw.

Every tenth graduation is made ½ in. long and all the others ¼ in. long. Commencing at zero, every tenth graduation is numbered, the first 10, the second 20 and so on. For convenience a plus sign should precede the numbers toward the high rail and a minus sign those toward the low rail. In order to allow the rod to be read from both sides, each edge of the same side is graduated and numbered, the same figures, of course, being opposite each other but reversed.

For the opposite side of the rod, or that side which is used to set stakes which fall outside of the rails, the graduations are somewhat different. Since, when the half-throw is greater than +141, the top lug is hooked against the gage of the high rail, that point must be used as a basis for graduations above +141. The graduation for a half-throw of +150 falls 1¾ in. from the top lug, and from that point to a half-throw of +280, the 0.2-in. graduations are laid off. For half-throws greater than



Three Views of the Rod Showing the Method of Graduation.

—150, graduations of 0.2 in. are laid off from the opposite end of the rod up to —280, taking the end as a half-throw of —150.

It can be readily seen that, with the half-throws of the curve before him, the operator can immediately, without any calculations, transfer them to the rod and proceed with the setting of stakes and tacks. The rod has been purposely made 58¼ in. long, in order that, in setting stakes for half-throws of over —150, the operator can first, with the rod in the normal position, make a mark on the low rail at —150 and then turn the rod over and, with the end on this mark, set stakes for any half-throw between —150 and —280.

For stakes that fall under the high rail and can not be set in their correct positions, it is suggested that they

*The string lining of curves was explained in a series of six articles appearing in the January-July, 1928, issues of *Railway Engineering and Maintenance*.

be set one foot inside the center line of the curve or toward the center of the curve, while stakes that come under the low rail should be set one foot outside the center line or away from the center of the curve. Such stakes should be appropriately marked to inform the foreman of their position relative to the true center line of the curve.

Different methods can be used for locating the tack on the stake but it is suggested that the stakes be driven nearly flush with the top of the ballast and a small plumb bob with a short string be used to plumb down from the rod to the stake. A small level bubble can be set into the rod near the center to facilitate leveling the rod when there is considerable elevation in the curve. The rod is equipped with a sliding metal attachment to enable the operator to set the desired reading on the rod and hold it by means of a thumb screw. This attachment has notches on either side of the zero reading to accommodate the plumb bob string. It is held to a sliding fit by a flat spring pressing against the face of the rod directly under the thumb screw.

Getting More Service From Tools and Materials*

By R. M. BLAYDES
Roadmaster, Kansas City Southern, Texarkana, Tex.

WE CAN make no better resolution than to determine to get the full service value from every piece of material that is in use. This can be accomplished only by thorough inspection and upkeep in every phase of the work of the maintenance-of-way department.

Probably the most important phase of this work is the care of rail and rail joints. When this part of the work is neglected and the joints are allowed to become loose and the rail improperly seated on the ties, unnecessary wear and strain on the whole track structure begin at once. If the bolts at a joint are allowed to become loose and to remain in that condition for any length of time, the angle bars will also work loose, causing the rail ends to chip and resulting in additional wear on the angle bars and frequently in broken bars. After the rail ends have become battered and surface bent from this loose condition, the result is a pounding joint which in turn makes it necessary to renew the ties about twice as often as at normal joints, and requires continual care to keep them tamped up properly.

It is important that the rail be kept properly seated on the ties and that a good gage be maintained. Poor gage will permit the wheels to run from one side to the other, causing additional wear on the rail and bad riding track. When permitted to run loose in the spikes, the rail is damaging to the ties, not only because of its movement but also because small pieces of gravel and other ballast are allowed to get between the rail and the ties.

In the proper handling of ties, it is necessary to protect them from damage by fire, water and other causes, to handle them with care during installation in order to prevent bruising or cutting which might lead to decay, to determine that the ballast is well drained so that the ties are not resting in wet and sloppy beds, and to ascertain that the track is so maintained that the wear on the ties from the movement of traffic will be reduced to a minimum. The ballast can be conserved by keeping the shoulders built up to hold it in place and to prevent it from running down the bank. Good drainage also assists in maintaining the ballast in the proper shape and condition.

Realizing the importance of getting full service value from all material in use and always keeping in mind the safe and efficient manner in which the track must be maintained, the next consideration is the care of the material, tools and other supplies which are on hand and not in use. Frequently this class of material is not kept picked up and assembled at the tool houses or other designated locations. Since motor cars came into use, it has been my observation that the foremen are not as careful about picking up loose material and scrap scattered along the track, owing principally perhaps to a reluctance to stop the car. Another habit which results in waste is to leave unused material on the job with the intention of picking it up later. Then when an opportunity is presented to collect the material it is either missing or the ballast plow has covered it over.

Turn in Excess Tools

Some of us carry on hand tools and material which we do not need in the efficient conduct of our work. Carrying too much material and too many tools on hand results in the money represented by their value being tied up so that it does not produce any revenue. Some foremen are inclined to carry on hand more tools than are needed, with the thought that an emergency or an increase in forces may create a need for them. However, when extra tools are held on hand, it means that new tools must be purchased to supply section or extra gangs that actually need them. It often happens that the purchase of new tools can be avoided if every extra tool is turned in so that it can be issued to supply real needs.

Any tools or materials that are not needed should be turned in to the supply cars and credit obtained for them. The supply of frog bolts should also be checked and any odd sizes or surplus bolts returned. In calling for new bolts, care should be taken to draw from the supply car only the size of bolt that is needed. It is not uncommon to find guard rail and heel filler bolts of improper length in use, a condition which can be corrected by getting the correct length of bolt in the first place.

On the Big Sandy & Cumberland Line of the Norfolk & Western

*Abstract of a paper that was presented before a recent meeting of the Kansas City Southern Maintenance of Way Association.

WHAT'S THE ANSWER?

Have you a question you would like to have someone answer?
Have you an answer to any of the questions listed here?

Buckling Track

What precautions should be taken to prevent track from buckling when surfacing during hot weather ?

Important to Have Dependable Foremen

By R. W. E. BOWLER
Engineer Maintenance of Way, Pennsylvania, Buffalo, N. Y.

One important precaution in this respect is to have efficient and dependable foremen in charge of surfacing that is done in hot weather. Before the raise is started, he should make a careful examination of all of the rail joints within the limits of the raise, to insure that there is a good average of expansion throughout. If the survey develops tight joints, shorter rails should be set in at proper intervals to obtain the needed expansion. At the same time the anti-creepers should be examined to insure that they are applied properly with respect to position on the rail as well as against the ties.

Frozen joints constitute another item that should not be overlooked. While this feature should be watched closely both during and after the raise, an experienced foreman can almost always detect them in advance. By loosening the bolts slightly and tapping the joint with a hammer, this hazard can be eliminated easily.

If anti-creepers are not being used, extra precautions must be observed with reference to expansion and frozen splices, and at road crossings, turnouts and any other places where there is a tendency to hold or retard the track from making its normal creeping movement when disturbed by raising.

Where the raise does not exceed two inches, which is about the normal limit for ordinary maintenance, a track that is reasonably well filled with ballast should withstand the effect of such surfacing without buckling, without it being necessary to apply new ballast in advance.

There is nothing new in the precautions which have been mentioned. The really important factor, as I see it, is the character of the foreman who is delegated to do the work. He should observe conscientiously all of the precautions and be constantly alert during the operation. It is my observation that in all cases of buckling track, some or all of these items were not given proper consideration beforehand, and that a good foreman would have corrected the trouble before the damage occurred. This refers not alone to track that is being worked, but to all other cases of buckling track as a result of wide ranges of temperature.

Keep Shorter Emergency Rails on Hand

By ROBERT WHITE
Section Foreman, Grand Trunk Western, Drayton Plains, Mich.

Good judgment dictates that every preparation should be made in advance to mend the situation if the track buckles, and then take every possible precaution to prevent its doing so. A pair of rails that are several inches shorter than those in the track should be kept on hand, together with a full complement of tools for inserting them and lining the track, if it should buckle.

Ballast should be removed only so far as is necessary to facilitate the work. The jacks should be placed opposite each other and brought up together at a moderate rate. Racing the jacks is often responsible for buckling and, in any event, this practice is likely to increase the amount of lining that is necessary.

Slacking off the spikes and loosening the bolts slightly gives the rail an opportunity to adjust itself to the temperature, so that sometimes this is the only action that is necessary. Often, track that has buckled can be lined to

To Be Answered in the October Issue

1. *When precurving rails, should the middle ordinate be made equal to or greater or less than the actual mathematical ordinate of the curve in which they are to be laid? If greater or less, how much? Why?*
2. *When should the inspection be made to determine the following season's painting requirements? Who should be in charge and who should accompany the inspection party? What details should be observed? What are the indications that determine whether repainting is required?*
3. *When installing guard-rail clamps, should the wedge be placed against the guard rail or against the running rail? Why?*
4. *Should the pockets of locomotive coaling stations be lined? If so, what material should be used and how should it be applied? How can repairs be made?*
5. *How can one distinguish between right-hand and left-hand compromise joints when there is no stamping to indicate the one from the other?*
6. *To what extent can the water service forces make repairs to the various types of valves? Is there any economy in their doing so?*
7. *When surfacing, should the tamping be done over the full distance between the rail and the end of the tie? If not, how far should it extend? Why?*
8. *Where a pile or timber trestle continues to get out of line and surface, what defects should be looked for? What methods should be employed to remedy the trouble?*

a long swing for the purpose of letting trains over, and then resorted to its proper position in the evening when the rails have cooled somewhat.

Raise Both Rails at the Same Time

By T. E. QUINN

Assistant Engineer, Wabash, St. Louis, Mo.

It is a relatively simple matter to prevent buckling, provided the work is kept well in hand day by day and the proper precautions are observed in every operation. Both rails should be raised and tamped at the same time, to eliminate any chance of side thrust. Skeletonized track buckles very easily. For this reason, the track should be kept well filled with ballast, particularly at the joints and at the ties where anti-creepers have been applied.

Generally it is advisable to loosen the bolts enough so that all expansion openings may be effective and, in extreme cases, it may be necessary to insert short rails at intervals. The use of rail anchors, which reduces the tendency of the rail to creep, has modified the hazard of tight rails which originates from this cause.

Should Provide Sufficient Expansion

By R. H. GILKEY

Division Engineer, Central of Georgia, Savannah, Ga.

When working track that is known to be too tight for safety, sufficient expansion should be provided before it is disturbed. This can be done in either of several ways well known to trackmen. With the wide use of anti-creepers, tight rail that is caused by creeping is not so common as formerly so that it is seldom necessary now to drive rail for long distances to relieve the longitudinal pressure stresses.

If ties are being renewed as part of the operation, do not remove more than two adjacent ties at one time. Replace these and spike them before any of the others are disturbed, and have all ties full spiked before a train is allowed to pass. Finally, keep the track filled with ballast both in advance of and behind the work.

Keep The Track Filled With Ballast

By J. J. HESS

General Roadmaster, Great Northern, Seattle, Wash.

Two important precautions must be observed if buckling is to be prevented when surfacing during hot weather. The first is to insure that the rail is not too tight, and this can often be avoided by slacking off on the bolts enough to permit free expansion. The other is to keep the track filled in as close before and after the surfacing gang as is practicable. Where sun kinks are likely to occur, it is poor judgment to have very much skeletonized track. I have found in some cases that it is advisable to provide the surfacing gang with a set of switch points to avoid unreasonable delays to trains.

Avoid Cutting Rails, If Possible

By J. R. WATT

General Roadmaster, Louisville & Nashville, Louisville, Ky.

I am of the opinion that tight rail which tends to cause buckling track is not so much the result of improper expansion allowance when new rail is laid, as to failure to hold the rail where it is laid. It has been my experience that the worst cases of buckling do not always come in hot weather, but are likely to occur in the first warm days of the spring, before the rail has had an opportunity to adjust itself fully after the cold weather. It is essential to see that splices are not so tight as to prevent the rail from absorbing the full expansion allowance. It will help where bolts are slackened to avoid tightening them again until after the track has been surfaced.

So far as possible, disturbance of track in which rail is known to be tight should be avoided during the hot weather. Where it is necessary to work the track under these conditions, it is essential that the runoff be kept well tamped and in good line, and the track well filled with ballast as close behind the work as possible. The speed of trains should be carefully governed.

I would advise cutting rails to relieve such conditions only where absolutely necessary, as this practice always results in having excessive openings between rail ends at some other point.

Stock of Pipe Fittings

How large a stock of pipe fittings should a water-service repair gang be permitted to keep on hand for normal maintenance use ?

An Ironclad List Is Impracticable

By R. C. BARDWELL

Superintendent Water Supply, Chesapeake & Ohio, Richmond, Va.

It is impracticable to give a definite list of pipe fittings for normal maintenance use which will have a general application for water-service repair gangs. Practice varies widely as between different railways and frequently differs radically as between the divisions on an individual road. A water-service repair gang that is engaged primarily on well work, tank erection or repairs to steam, electric or oil-engine stations, will require an entirely different stock from a gang that maintains plumbing, heating installations, or gas lines. Proximity or accessibility to central or local storehouses and the conditions of the stock reserve at such points may also be a controlling factor. The condition of the equipment in the water stations will also affect the character and amount of stock that the gangs should carry.

It is believed that the greatest economy and best results in controlling such stocks, as well as other material supplies, can best be achieved by handling each situation in accordance with the best judgment of the local supervisor or of the system officer who is directly responsible for the performance of the gangs. Usually, the best practice is to maintain sufficient stock with the repair gangs to provide for possible emergency requirements, and to care for the regularly programmed maintenance work. This can be properly and advantageously controlled, however, only in the light of a full knowledge of the local conditions and of the work to be done.

Stock Can Be Kept to a Minimum

By J. B. WESLEY

Engineer of Water Service, Missouri Pacific, St. Louis, Mo.

This will depend on the character and magnitude of the pipe installations to be maintained and on the local conditions. In terminals, where there are extensive systems of air, heating and small water lines, it is necessary that a considerable stock of fittings be available for use. As a rule, however, there is a storehouse accessible, from which the fittings can be drawn, in which case it is unnecessary for the water service forces to carry any stock except what may be necessary for emergency repairs. Large installations of air, heating and small water lines

are seldom found outside of terminals, so that the fittings carried by the maintenance gang can safely be kept to a low minimum.

Fittings for large sizes of pipe, for both terminal and road use, should be carried in the general store, except, perhaps, such as may be required at certain critical points where experience has shown that emergency repairs are required more or less frequently. An example is a location where a suction line with a foot valve extends into a stream and is likely to be broken off by drift and rubbish.

Changing practices in recent years have materially altered stock requirements for repair gangs. The extended use of welded pipe joints has had the most profound effect in reducing such stock requirements. Welded pipe and connections leave few or no fittings to be replaced by the repairmen. Furthermore, sections of pipe can be inserted and welded, thus eliminating the need for fittings in making repairs to old lines.

By properly extending the practice of welding and then relying on the general store to carry an adequate stock for normal maintenance consumption, the stock carried by the gang need be only sufficient for emergency requirements. This should include from two to four each of unions, tees, ells, nipples, valve discs and valve seats for each size of pipe from 2 in. down to the smallest in service.

Renewing Ties

What incidental work should be given attention while ties are being renewed ?

Line and Surface Should Be Watched

By H. R. CLARKE
General Inspector Permanent Way, Chicago, Burlington & Quincy, Chicago

The question is of such a general character and ties are renewed under such a wide variety of conditions that it is difficult to give a specific answer. When tie renewals are made while reballasting, all of the incidental work which accompanies reballasting must of necessity be done.

When spotting in ties, one of the most essential things is that of correct gage. All new ties should be gaged correctly, even though this means gaging the adjoining sections of track. Tie renewals should properly include the placing of the tie plates, spiking, tamping, dressing the ballast where it has been disturbed and disposal of the old ties, and these items are not to be construed as incidental work.

Attention should be given to the general riding condition of the track, smoothing the surface and doing such lining as may be necessary. If the renewals are heavy, the riding qualities are likely to be affected, so that special attention should be given to keep this up to the required standard.

Restoring the ballast section is part of the tie-renewal operation, but incidentally the ballast should be dressed at all points where this would improve the general appearance, although it might not have been disturbed by the tie renewals. Likewise, pulling or cutting occasional bunches of weeds or grass is incidental work that should be done.

Other work that should be done, if the size of the force permits, includes tightening bolts, cleaning ditches, etc. As a rule, however, it is better to confine the work to the roadbed section, pushing the tie renewals as rapidly as possible and keeping the incidental work to the minimum that is compatible with good track. I would like to emphasize again the importance of gaging as the ties are renewed, since this is so frequently overlooked.

Tie Renewals and Surfacing Go Together

By LEM ADAMS
General Supervisor Maintenance of Way, Union Pacific, Omaha, Neb.

When a considerable allotment of ties is approved for installation in a specified time, the trackman likes to get them in his track as quickly as possible for the reason that new ties provide a strong track. He is likely, therefore, to slight all other work until his ties are in. This is not the economical method to employ, however, as tie renewals should be made as the track is worked over in the spring, where lining and surfacing can be handled incidental to tie renewals; likewise, the ballast shoulder should be smoothed up at this time.

On branch line territory, particularly if the track is not ballasted, it is essential that tie renewals be taken care of in connection with surfacing, as it is a waste of labor to dig out dirt track only to renew ties. There has been a lot of tie waste, as well as loss in labor, from rushing tie renewals in branch line tracks. I do not believe in going out to hunt for ties to renew, as a trackman will always find the weak ties when he lifts his track for surfacing.

It has been my observation that the most wasteful practice that could be resorted to is to give a section foreman a definite allotment of ties to put in during a single month or other short specified period. We give our foreman an allotment to serve as a maximum only, in order that they will not exceed their money allowance, but do not insist that they get in all of them within that period.

The important thing is to install the new tie properly by getting it tamped just right to prevent the necessity of additional spot surfacing after the tie is in, or of having to rework that particular section of track all summer to take care of swinging new ties.

Obsolete Bridge Timbers

What use, if any, can be made of obsolete bridge timbers of odd sizes, which are not suitable for use in standard timber trestles ?

There Are Many Outlets for Odd Sizes

By C. A. LICHTY
Material Inspector, Chicago & North Western, Chicago

The time is past when any railway can afford to carry in stock for any length of time a surplus of obsolete or odd-size lumber awaiting an opportunity to use it to best advantage at some indefinite time in the future. The smaller sizes of such stock, not of standard dimensions, which may be left over from either construction or maintenance work, can frequently be used in form work or in the bracing of forms. The larger sizes can nearly always be worked into falsework in both construction and maintenance.

A great variation is required in the character of the falsework that is necessary in the construction or replacement of piers, abutments, concrete boxes, and other forms of masonry. The same is true for placing girders and other steel spans. It is seldom that such falsework

cannot be so designed as to utilize odd-size or obsolete timbers. Temporary bents for a great variety of purposes offer a further outlet for such material. These timbers can also be utilized in the construction of platforms for unloading automobiles and heavy machinery and in temporary structures which often must be erected at terminals and elsewhere.

Where an accumulation of odd-size or obsolete timbers has occurred beyond the possibility of use within a reasonable time, it may be good policy to have them sawed into standard sizes of lumber at some company shop, and added to the regular stock of building material. At times, it has been advantageous from the standpoint of cost to have obsolete timbers resawed at a commercial mill adjacent to spur tracks, provided this did not require extensive handling or a long road haul.

It requires sound judgment on the part of the responsible officer to make the best disposition of both second-hand and odd-size timber and lumber. Before the decision is made, the list should be submitted to every division and using department to ascertain whether all or any part of it can be used elsewhere to better advantage than on the territory where it is located.

They Should Be Resawed to Standard Sizes

By W. A. SUMMERHAYS
Manager, Forest Products Inspection and Research Bureau, Illinois Central, Memphis, Tenn.

Many uses can ordinarily be found for odd and obsolete sizes of bridge timbers in the regular course of railway maintenance or construction. If these timbers are new and untreated, however, it is usually best to resaw them into standard sizes, so that current use can be made of them. If they are either new or second hand, but have been treated, they can be used as foundations for small buildings, mud sills, to repair standard trestles and as bulkheads for new trestles. Second-hand untreated timbers of odd sizes can often be worked into platforms and truckways that carry heavy loads, or they may be used as curbing for cinders or screenings platforms on secondary lines.

Simplification Eliminates Odd Sizes

By Engineer of Bridges

Simplification of the standards for bridge timbers is a matter greatly to be desired. Such action would simplify manufacturing problems and enable the mills to carry a certain amount of standard stock which would always be quickly available. They are unable to do this at present, because of the multiplicity of cross-sectional and length dimensions now demanded by the railways as a whole. Until this is accomplished, individual roads can do a great deal in this line and thus effect a marked reduction in their own storehouse stocks.

Such simplification and a strict adherence to standards will practically eliminate an accumulation of odd-size and obsolete timber, except at first when making the change in standards. At this time, however, there should be enough structures of the previous type to provide a ready outlet in maintenance for any reasonable amount of the former sizes.

Should an accumulation occur for any reason, however, which is beyond the capacity of the existing structures to absorb in maintenance, the stock can be applied in the construction of automobile and heavy machinery platforms and ramps, and other special structures for which standards cannot easily be developed. Falsework to carry the tracks during the construction of piers, abutments or concrete boxes, for the erection of steel bridges and for temporary openings can always be designed to utilize stock of odd sizes. In fact, an alert supervisor will find all sorts of uses where such material can be substituted for standard stock.

Wide Gage

What effect does wide or irregular gage have on track maintenance and the riding qualities of the track ?

Standard Gage Important Through Turnouts

By T. E. QUINN
Assistant Engineer, Wabash, St. Louis, Mo.

Slightly wide gage on open track does not create any hazard, provided the tie conditions are good and the spikes are driven home, although it may have an adverse effect on the riding qualities of the track. It is at switches primarily that wide and irregular gage creates the greatest hazard.

Facing-point switches in tracks which carry traffic in one direction only generally have the frog driven back by traffic, with the result that the gage is widened. Likewise, the movement of the frog is forward for trailing switches, so that tight gage results. Both cause a well-defined side jerk as the cars pass.

Guard-rail gage is a constant distance between the gage side of the guard rail and the running rail of the frog. I have been surprised to find that many foremen are not aware of this but are under the impression that it is a flangeway of unvarying width between the guard rail and the running rail, regardless of the track gage. Ignorance on this point may result in variations in gage that are far from safe.

Evidence of wide guard-rail gage is given by marks showing that wheel flanges have struck or mounted the guard rail and by the fact that the spikes in the frog become loose as a result of the lateral blows given by the wheels. On the other hand, narrow guard-rail gage causes wear along the side of the frog point and point rail.

If the gage at the switch points is tight, the wheels may strike the point and split the switch. If it is wide, the points are likely not to fit tightly against the stock rail so that a rocking car or sharp flange may split the switch. Cases have also been known where defective wheels have struck the opposite point. These conditions emphasize strongly the importance of maintaining both track and guard-rail gage to standard through turnouts.

Causes Much Discomfort in Riding

By Engineer Maintenance of Way

Wide, but more particularly irregular, gage results in almost as much discomfort in riding as irregular surface. This effect is more pronounced on tangents than on curves. In other words, if the flanges are guided in a direct route, the movement of the car is steadier than if the wheels are allowed sufficient room for lateral movement, so that they strike alternately on one side of the track and then on the other. This is what happens when the gage is wide.

It will be observed that where car wheels and track are both standard, there is ample room to provide the

clearance that is necessary between the flanges and the rail head. Yet there is not enough space to allow a lateral movement of the wheels of sufficient amplitude to affect the riding qualities of the car.

I have known at least two good section foremen who maintained the gage over their entire sections slightly tighter than the standard. One even tightened it more at his frogs than elsewhere. A record of his frog renewals proved that his frogs not only lasted longer than the others on his district, but it was always noticeable that they rode better and made less noise under passing trains. Nothing destroys frogs and crossings more quickly than wide gage.

Seriously Affects Riding Qualities

By R. H. GILKEY

Division Engineer, Central of Georgia, Savannah, Ga.

Wide or irregular gage seldom, if ever, remains in a static condition. Owing to the lateral thrust of the wheels it will soon become irregular or the irregularity will increase progressively until measures are undertaken to correct it. On tangent track there is a well defined lurching of the cars when passing over either wide or irregularly gaged track, which may become fully as uncomfortable as that caused by uneven surface. On curves, the rail wears unevenly and the lateral blows from the wheels cause the gage to widen still further very quickly and will throw the track out of line. No trackman can expect to have good riding track unless he keeps his gage standard.

Gage Is Specially Important on Curves

By Roadmaster

Gage that is not wider than one-half inch will not perceptibly affect the riding quality of the track on tangents, provided it is regular. On curves, it will force the track out of line and this in turn results in poor surface. My greatest objection to moderately wide gage on curves is the damaging effect on the inside or low rail. If the superelevation amounts to three or more inches, the wheels grind out the running surface directly over the web, giving it a hollowed-out appearance, unless the gage is maintained correctly.

The riding qualities of the track can be restored by regaging, but the damage to the rail can never be repaired, and the rail must eventually be replaced long before it would otherwise be necessary. When regaging is done, the outside edge of the head carries the load and, under heavy tonnage the ball will shear over the web in much the same way as rail that has been relaid and not properly canted. These conclusions are based on the assumption that the gage is only moderately wide.

Poor Gage Results in Poor Line

By H. BECKER

Section Foreman, St. Louis-San Francisco, Rush Tower, Mo.

I consider the maintenance of correct gage to be one of the most important duties of a trackman. To mention a minor matter first, the entire appearance of a track is spoiled by the sinuosities of the gage rail where the gage is irregular. Both engines and cars are inclined to lurch when passing over either wide or irregular gage, and this is particularly true of engines with too much lateral. One has only to watch the "snaking" action of a locomotive when running on track with either of these defects, to understand why it is so quickly thrown out of line. Throwing the track out of line always results in defective surface. Alone, or in combination, these two defects tend to force the spikes out, so that the rails become loose in the spikes and the deterioration of the track continues progressively until it is rehabilitated and the primary cause corrected. Furthermore, where the gage is too wide on curves, the head of the low rail flattens out from both wear and flow of the metal, so that its life is definitely shortened.

Tracks Cannot Be Maintained Properly

By A. J. BOWERS

Supervisor, Wabash, Toledo, Ohio

Wide gage that is uniform is not quite so serious a condition as gage that is irregular, but either will affect both line and surface where highspeed trains are operated, and both have a decidedly adverse effect on the riding qualities of the track. Irregular gage, and to only a less degree wide, but uniform, gage causes the cars to lurch, forces the track out of line and, as a direct result, out of cross level and surface. The rails spread and get loose in the spikes and continue to do this progressively until the condition is corrected. It is not debatable that track cannot be maintained properly or economically with wide or irregular gage.

Platform Flooring

How can a wood-plank floor on an outside platform be laid to facilitate trucking ?

Planks Should Be Sorted Carefully

By I. ANDERSON

Division Engineer, Atchison, Topeka & Santa Fe, Argentine, Kan.

Two factors contribute to make wooden floors on outside platforms unsatisfactory for trucking service. These are uneven thickness and poor matching of the planks when laid, and uneven wear in service. To overcome the disadvantage of uneven material, the planks should be planed to a uniform thickness and width before they are used. To minimize, so far as possible, the difficulties which result from uneven wear, the planks should be sorted carefully and laid so that pieces of approximately the same quality will be placed next to each other. So far as possible, also, the planks for individual floors should be selected for uniform quality. After these selections have been made, the planks should be laid diagonally to the direction of the trucking.

Black Gum Plank Is Superior

By A. L. SPARKS

Architect, Missouri-Kansas-Texas, St, Louis, Mo.

Wood platforms, when newly laid of boards of even thickness and well nailed, generally provide a smooth surface on which to truck. Little difficulty is experienced while they are new but the boards have a tendency to wear on the edges and as they shrink and the cracks become wider, the truck wheels drop down into one crack after another, causing more wear and a greater drop so that the trouble is increased with age and use. The surface eventually assumes an appearance similar to that of a washboard, over which it is difficult to haul heavily loaded trucks without the cargo being constantly jostled and shifted or toppled over.

The problem then, is how to avoid this rapid wear and corrugated surface. The planks on many long plat-

forms are laid lengthwise or parallel with the line of travel. This provides a more satisfactory trucking surface and generally fosters longer life. Where conditions require the boards to be laid at right angles to the line of travel, thin sheets of steel, 8 in. to 12 in. wide, are often countersunk or recessed into the boards, providing a perfectly smooth, even track for truck wheels. This method has proven satisfactory in many places and greatly facilitates trucking. The steel plates must be laid with wide open end joints to permit expansion on hot days, otherwise the plates will buckle and pull loose from the boards.

Some platform surfaces have been improved by laying the boards diagonally. This system minimizes the first objection but does not eliminate it.

The writer has observed recently a number of very satisfactory wood platforms surfaced with 2½-in. creosoted black gum plank. The gum is so hard and dense and the fibers are so interlaced that the boards wear very slowly. There is a greater tendency toward warping, however, so that extra heavy spikes must be used. One engineer found that by using creosoted gum joists he could secure much greater holding power for his spikes and experienced no difficulty from the plank warping and pulling loose.

Creosote treatment is sometimes objectionable on platform surfaces where freight may become damaged by coming in contact with the surplus creosote. This generally happens with the more porous woods which are capable of taking heavier treatment, but because of the density of gum the surplus oil is readily disposed of so that little or no complaint results.

Whatever system is used, in order to have a satisfactory trucking surface, it is necessary that the girders and joists be sized to an even height and the decking be of a uniform thickness. The plank must also be thoroughly spiked with no fewer than two spikes to each joist. Good sound joists 3 in. or more in thickness are recommended in order to prevent the spikes from splitting out. A true surface on a wooden platform depends largely on the holding power of the spikes. The use of scrap material for platform joists may, therefore, prove to be false economy.

Diverting Traffic

On multiple-track lines, what advantages, if any, are there in diverting the traffic during the working period of the day to facilitate the laying of rail or the installation of ballast ?

Detouring Definitely Reduces Costs

By W. C. BARRETT
Trainmaster, Lehigh Valley, Buffalo, N. Y.

The Lehigh Valley was one of the first, if not the first, road to use power machines extensively in maintenance. One of the earliest developments of this character was the use of locomotive cranes for laying rail. It is our experience that, to use such machines effectively, it is necessary to have the exclusive use of the track while the rail is being laid. Our usual practice is to detour traffic during the working hours while the rail laying is in progress. If the schedules require the diversion of a considerable number of trains, we generally install facing-point crossovers to eliminate the necessity of back-up movements in crossing the trains over to the other track. We have detoured for as great a distance as 10 miles with not more than 5 to 10 min. delay to passenger trains nor more than 15 min. delay to freight trains.

Co-operation between the transportation and maintenance departments is the secret of the successful use of heavy power machines, particularly of locomotive cranes in laying rail. The fact that power machines have been used successfully on this road for the last 15 years and that attractive savings have been made through their use, has been due entirely to the close co-operation between these departments. Not only has the cost of maintenance work shown a marked reduction through the use of power equipment as a substitute for hand labor, but its use has also reduced the number of stops of both freight and passenger trains, and has been a factor in reducing fuel consumption and the road time of train and engine crews.

As an illustration of the value of the practice of diverting traffic, eight track miles of 136-lb. rail was to be laid recently. We installed a temporary crossover at one end of the work and detoured for approximately nine miles. One locomotive crane and a gang of 125 men, working from 7 a. m. to 2:30 p. m., with 20 min. for lunch, laid one side, or eight miles of rail, the first day and the other side the next day.

There were no delays of consequence to trains and, hence, only a negligible addition to transportation expenses. Had this rail been laid by hand under traffic, it would have required approximately two weeks work, with numerous delays to trains.

We are thoroughly convinced that it pays to divert traffic to give the maintenance forces the exclusive use of the track for laying rail. We are also giving them the track for cleaning ballast and other similar work where conditions make such an arrangement desirable.

Cost and Local Conditions Must Decide

By G. D. MAYOR
Assistant Cost Engineer, Chesapeake & Ohio, St. Albans, W. Va.

This is a difficult question to answer offhand, since a given situation might show gratifying economies for one class of work and yet not be suited to some other. The density of traffic, the quantity of power equipment to be used, the ease with which it can be placed in the clear, the number of laborers employed in the operation and whether the track is equipped with either-direction signaling, so that trains may be diverted without the use of 31 orders, are only a few of the items that must be considered in arriving at a decision.

Having a specific case in mind and a thorough knowledge of the conditions to be met, it is possible to reduce to dollars and cents the cost of working under traffic and compare this with the cost of the same operation performed on a track that is free from traffic. This difference, compared with the cost of diverting trains, gives the information necessary for making a decision.

On the territory with which I am familiar, which carries a heavy traffic, it has been advantageous to divert traffic while laying rail. The rail gang consists normally of 90 men, and is equipped with a rail crane and with a full complement of pneumatic tools which require the use of several air compressors mounted on the track, since they must keep abreast of the several operations to which they are assigned.

We have not found any economy, however, in diverting traffic for heavy ballasting work, as in this case there is no power equipment to occupy the track. The compressors which serve the tie tampers are placed on timber cribs alongside the track. They move on the rails only when it is necessary to transfer them to a

new location. A portable telephone, that can be attached anywhere along the line, is provided, by means of which the foreman is able to keep in touch with the dispatcher, preparing his runoffs as needed.

Advantages of This Practice Are Manifold

By T. E. QUINN
Assistant Engineer, Wabash, St. Louis, Mo.

Of late the practice of diverting traffic on multiple track lines during rail-laying and ballasting operations has proved to be economically advantageous on a number of roads. The detouring of trains for short distances has generally resulted in negligible increases in the cost of operation, while the advantages to the maintenance forces are manifold. Among these are:

Elimination of the time required for closure or clearing tracks and waiting for trains.

Ability to use large power equipment continuously and, therefore, economically, which cannot be done under traffic.

Increase in the productive time of the track forces, thus reducing the period of traffic interruption, as well as the aggregate of train delays.

Elimination of the possibility of derailment as a result of sun kinks just ahead of or under trains.

Where there are more than two tracks with permanent facing or trailing cross-overs, or where there is a long passing siding on double track lines, the detouring of trains is simple and inexpensive.

On the other hand, where there are only two main tracks, there may be a serious curtailment of operating facilities, particularly under close train schedules. To meet operating requirements, it is often necessary to install temporary crossovers to avoid reverse movements or shorten the detour. Portable telephones and flagmen at these crossovers facilitate train movements. It is also generally advisable to have an assistant trainmaster on the ground to direct train movements and act as liaison officer between the track forces and the dispatcher. Normally, the cost of installing temporary crossovers and detouring traffic is small as compared with the savings effected in the track work. To make it successful, however, the entire project requires the closest cooperation between the two departments. The shorter period of interruption to traffic is a distinct advantage to train operation and, usually, more than offsets the small delays and difficulties of detouring.

Saves Both Time and Expense

By ROBERT WHITE
Section Foreman, Grand Trunk Western, Drayton Plains, Mich.

The practice of diverting traffic for laying rail results in definite savings in the time of the forces and the total cost of the work, including the cost of making the diversion. There is a real loss in stopping a large rail gang to close the track for the passage of a train, since a considerable part of what is done is temporary in character. If the train does not arrive at the time scheduled, this loss is increased, as little, if any, productive work can be done until it has passed. Furthermore, most foremen close up somewhat in advance of the expected arrival to insure against delaying the train, particularly if it is a passenger train, and this also adds to the loss of productive time. By diverting traffic, these losses are eliminated, the organization remains unbroken and the whole operation can be kept running smoothly and properly balanced.

Unless an unusually large gang is employed, I do not believe it to be necessary to divert traffic for ballasting. Through the use of a field telephone, the foreman can keep in touch with train schedules, and be ready for the passage of trains with a minimum of delay to both trains and workmen. When unloading ballast, the train can usually get in the clear and back again without serious delay, provided the foreman exercises good judgment as to the number of cars he can unload between trains.

Diversion Increases Productive Time

By J. J. HESS
General Roadmaster, Great Northern, Seattle, Wash.

It is safe to say that with moderate traffic, at least one-third more work can be accomplished on multiple-track lines by diverting trains during the working hours. As the amount of traffic increases, this difference in productive labor also increases. Important as it is to employ methods that will increase the amount of productive time of maintenance gangs, there is an added importance in this case in the fact that the quality of the work is also improved. Where traffic is diverted, there is no occasion to disorganize the operation, which always occurs when it is necessary to close up for the passage of trains, during which period more or less work is done that is sub-standard.

There Are Definite Advantages

By A. J. BOWERS
Supervisor, Wabash, Toledo, Ohio

The diverting of traffic to give rail gangs the uninterrupted use of the track upon which they are working decreases the cost of the work as much as 25 per cent in labor, while the saving in material is definite but variable. There is a marked loss in productive time whenever a closure is made for the passage of a train, depending on the accuracy with which the schedule given by the dispatcher is maintained. As the number of trains increases, this loss mounts almost in geometric ratio. Furthermore, every time a closure is made, unless the use of switch points is permitted, one rail, and perhaps two, is reduced to scrap through the necessity of cutting it.

Foremen should be able to give their undivided attention to the progress of the work and to balancing every part of it. It is not possible for them to do this with the maximum effectiveness if they must be on the lookout for trains and be prepared to get ready for their passage every little while. Again, every normal operation is disrupted in making closures and in tearing out the temporary work, while it takes a measurable amount of time to get the men back to their stations and working smoothly.

Practice Pays in More and Better Work

By H. BECKER
Section Foreman, St. Louis-San Francisco, Rush Tower, Mo.

A track gang, particularly if of large size, where the work is divided up into numerous separate but dependent operations, can do more and better work if it can avoid interruptions. This is especially true where the interruptions require an almost complete disruption of every part of the work, as is necessary in making closures for the passage of trains while laying rail. This is amply borne out in practice, particularly if there is any amount of heavy power equipment which must be placed in the clear.

To only a slightly less extent is this true in ballasting. While it is not necessary normally to disrupt the separate operations to quite the same extent as in laying rail, there is a definite loss of time, not only while doing the temporary work to permit the passage of trains, but in waiting for the train to go by and in getting the men organized after it has passed.

Although arrangements for detouring often include the installation of temporary crossovers and the employment of temporary operators or switch tenders, as well as the assignment of a trainmaster, the delays to traffic can be kept to a minimum, while the period of traffic delays is shortened. For these reasons, the practice has much to commend it, and only under conditions that are out of the ordinary will it be unsatisfactory.

Installing Falsework

What methods can be employed to install falsework for the construction of a new opening in an embankment where the character of the material in the fill or underlying strata does not permit the driving of piles ?

Start Cribbing At Top

By Supervisor of Bridges and Building

Where it is impracticable to drive falsework piles for the reasons given, there is ordinarily only one basic form of procedure, although local conditions may require numerous variations in the details. This is to reverse the usual method and start cribbing at the top, building it down as the excavation proceeds.

Normally rock, gravel or compact shales are the materials that act as a bar to the use of piles. Luckily, they usually afford a firm support for the cribbing, except some of the shales which are more or less compressible and which may become slippery when wet. In any event, the proper procedure is to excavate just enough for one timber at a time, provided traffic must be carried as the work advances. Large pieces of rock are sometimes difficult to remove and leave cavities larger than are needed for the timbers. Gravel and shales may also create difficulties by running or sliding into the excavation. For these reasons, it is always wise to have an ample supply of blocking in assorted sizes and plenty of hardwood wedges to tighten up the cribbing timbers.

If the underlying strata are suitable for piles, these may be driven after the natural ground is reached. If these strata are refactory, however, timber bents can be set up to support the stringers or carry long-span girders, if the latter are available.

Diverting Traffic Is Simplest Method

By Engineer of Bridges

On a multiple-track road, the simplest procedure would be to install temporary crossovers and run trains around the opening until the excavation has been completed, or partly completed if it is not practicable to excavate to the full depth at once in this event, repeating the process until full depth has been attained. This is not always practicable, however, in which case other methods must be employed, and these will depend in large measure on the physical conditions and the volume of traffic.

We had a case not long ago where a subway was constructed through a rock fill that carried three busy tracks on a mountain grade, none of which could be abandoned for even the distance occupied by the work. Because of the grade, 80 ft. to the mile, we were forbidden to stop trains. The job was bulletined and the flagmen were provided with yellow flags, red flags being reserved for use at the job in case of emergency.

Preliminary excavation was made to place stringers under the ties. The next step was to excavate at the ends of the stringers just enough to insert transverse timbers for their support. Other transverse timbers were then placed at intermediate points in the same manner, spaced at proper intervals to become part of a cribwork. The next course was inserted longitudinally, and this process was repeated until, when the base of the fill, which rested on solid rock, was reached we had a substantial crib of 12-in. by 12-in. timbers. This support was eventually replaced by temporary through girders supported on timber bents, which spanned the entire opening, since blasting was necessary to attain the full depth of the undercrossing.

Framed Bents Were Placed in Trenches

By D. RINTOUL

General Bridge Inspector, Southern Pacific, San Francisco, Cal.

We have had two jobs recently where falsework piles could not be driven. The first was a street subway which spanned two roadways and two sidewalks and provided for an electric railway. The site was underlaid with hardpan in strata 2 ft., 3 ft., and 4 ft. thick, each separated by thin strata of sandy clay. An attempt to drive piles failed completely.

Stringers were placed under the ties and trenches 4 ft. to 5 ft. deep were excavated at points of support for framed timber bents. The material between bents was then excavated slightly below the sills, care being exercised not to impair their support. Similar bents were then placed on either side of the first bent, about 3 ft. from it, and the trenching was repeated. This method was again repeated until full depth was attained. At a few points where the softer material was exposed, temporary piles were driven and used until this material could be removed.

In the second case, a mixture of shale and slightly disintegrated rock was encountered. Here the procedure was the same, except that blocking was first used at the points of support and the stringers were supported on cribbing instead of bents while the trenching was being done.

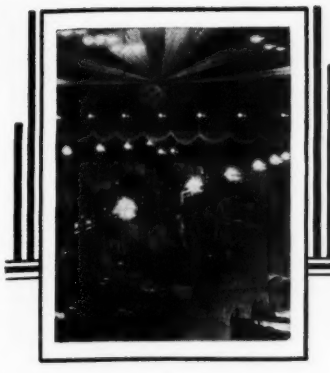
Set Posts Under Caps After Excavating

By A. FINNIS

Master Carpenter, Great Northern, Minot, N. D.

Several methods can be employed for placing falsework in embankments through which piles cannot be driven. The particular method used, however, will depend on the character of the material in the fill and the density of traffic. If the traffic is heavy, narrow trenches should be excavated for the insertion of standard bridge caps, after which stringers and bridge ties are installed. The next step is to dig a trench under each cap, starting at the side of the embankment and at the desired depth. As the material is removed, posts are set up, until an entire bent is constructed. It is often necessary to place sheeting to prevent caving. After the bents are completed, the remainder of the material can be removed with teams or a small power shovel. While this method requires considerable time and skill, it has the advantage that it does not interfere with traffic.

If traffic is light, the easiest and most commonly used method is to remove the track, make the excavation to the desired depth with a clamshell and install the falsework.

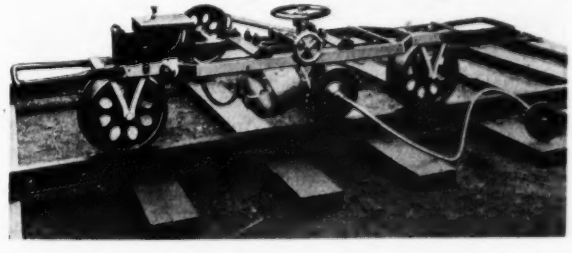


NEW AND IMPROVED DEVICES

New Electric Rail Grinder

ANOTHER model has been added to the line of rail grinders manufactured by the Railway Track-work Company, Philadelphia, Pa., designated as Model P-8, and involving a number of special features. The new grinder, which can be used both for the grinding down of welds made in building up battered rail ends and for slotting at the rail ends, is mounted on a two-wheel, steel frame car, 6½ ft. in overall length, provided with a readily detachable outrigger and third wheel for steadying the unit when in use.

The grinding mechanisms of the unit include essentially a 3-hp. ball-bearing motor, connected indirectly to a 10-in. high-speed grinding wheel, and a detachable auxiliary grinding wheel for slotting at the rail ends.



The New Model P-8 Electric Track Grinder With Flexible Attachment for Separating Rail Ends

All of this equipment is suspended from a movable carriage which is capable of 17 in. of longitudinal movement along the car frame on four heavy ball bearings enclosed in bronze housings. The carriage is also provided with lateral movement on ball bearings, so that the grinding wheel can be moved forward and backward over the rail head and across the head while the grinding car itself remains stationary. The longitudinal movement of the carriage is effected by a push or pull on the part of the operator, while the more restricted lateral movement of the carriage is controlled by a hand wheel and screw. The vertical feed of the grinding wheel is also effected by means of a hand wheel and screw.

As an auxiliary to the main grinding wheel for restoring the normal contour of the rail head after welding, a smaller and narrower grinding wheel is provided for cutting through the welds at rail ends to restore the normal expansion opening. This smaller wheel is operated through a flexible shaft, about five feet long, which is readily attached to or disconnected from the end of the shaft carrying the main grinding wheel.

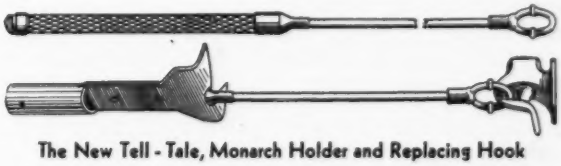
The grinding car as a whole, without the removable third wheel outrigger, weighs 355 lb., and is provided with a lifting arm at each end so that it can be removed from the track readily by two men. It is intended that on steam railways, power for the operation of the grinder, shall be secured from the generator of the electric welding outfit building up the rail, but the power can be supplied by a small general service gasoline engine-generator set moved along with the grinder.

New Tell-Tale and Holder

A NEW design of tell-tale and tell-tale holder, known as the Monarch, is being marketed by the Howard P. Cook Company, Bridgeport, Conn., which not only incorporates features intended to give the tell-tales long life, but permits the removal and replacement of the tell-tales from the track level, and their renewal, either whole or in part, as may be necessary.

The tell-tale consists of a length of treated cord, fitted with a brass tip on its lower end to prevent lashing and fraying, and held above by a brass thimble, which, in turn, is joined by a brass rod with a special loop at its upper end for hanging on the holder. One of the special features of the tell-tale is the arrangement provided wherein the cord can be renewed without replacing the brass parts. In this arrangement, the suspension rod, with a screw thread at its lower end, is screwed down through the top of the thimble and well into the upper end of the cord. This simple fastening makes it possible to renew the cord readily and, it is said, will withstand a pull of 400 lb. Another special feature of the tell-tale is the hanging loop provided, which has a lug on each side to make it impossible for the tell-tale to be blown or thrown over the lash board.

The principal feature of the holder, which is a bronze, hook-like casting, is a ball keeper which secures the tell-



The New Tell-Tale, Monarch Holder and Replacing Hook

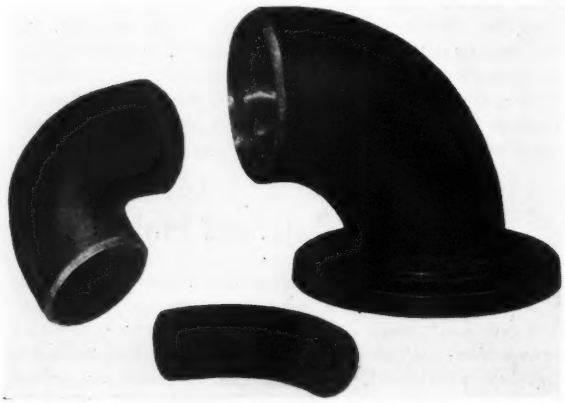
tale loop on the hook and prevents it from being knocked off or otherwise displaced. The keeper is essentially a bronze ball which protrudes from a well in the back of the hook casting, across the hook throat, and is held firmly against the prong of the hook by means of a phosphor-bronze spring behind it.

Removal and replacement of the tell-tales on the hangers is done with a pole, with a special notched

metal piece at its upper end. The metal piece is so cut that it supports the hanging loop of the tell-tale when it is being backed off from the holder, and engages the top of the cord thimble when the tell-tale is being snapped downward into place.

Develop Wrought Iron Elbows

THE development of wrought iron welding elbows, known as Weldells, has recently been announced jointly by the Locomotive Terminal Improvement Company, Chicago, and the A. M. Byers Company, Pittsburgh, Pa. These elbows range in size from 2 to 12 in. and are manufactured with the same center-to-face measurements as standard radius fittings. They are forged from



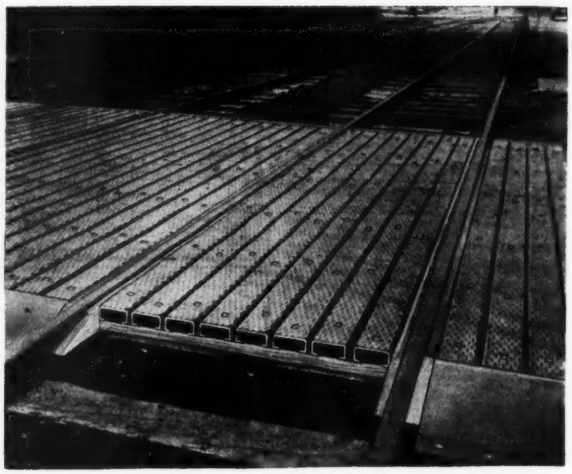
Several Views of the New Wrought Iron Elbows

wrought iron plate and are said to have a smooth, uniform internal diameter. Reinforcing ribs are provided along both the outer and inner radii of curvature. In the forging, a tangent is formed on each end, making the elbows interchangeable with standard fittings. They are also beveled 45 deg. for welding. Stock sizes include both standard and 10-gage sections, the latter being for use with standard light-weight spiral welded or spiral riveted pipe. The process of manufacture is said to permit these elbows to be made from the same material as the balance of the piping system.

An All-Steel Highway Crossing

THE Truscon Steel Company, Youngstown, Ohio, has designed and is manufacturing a new type of steel highway crossing which is known as the Truscon all-steel highway crossing. This crossing consists of checkered-steel plates laid parallel to the rails and spiked in place. In form, the plates resemble steel channels with the lower ends of the legs bent inward at right angles to provide a bearing surface against the support. These plates are 5½ in. wide, 3 in. deep and 9 ft. long and are made from ¼-in. steel. The length of 9 ft. is standard, although the plates may be obtained in lengths ranging from 1 ft. to 18 ft. They are fastened to the support and the ties by means of ⅜-in. spikes or lag screws inserted in holes in the plates, which are recessed so that the head of the screw or spike will not project above the level of the plate.

The plates are supported on sleepers resting on the ties so that they will present a surface level with the

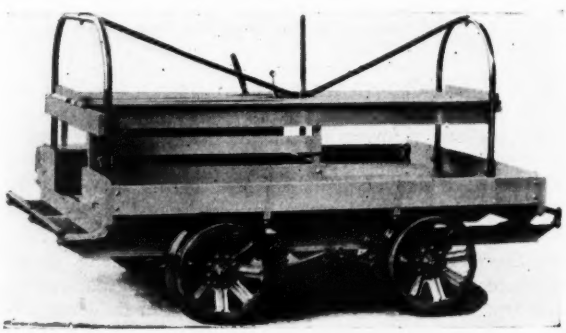


An Installation of the Truscon All-Steel Highway Crossing with one of the End Guards Removed

top of the rails. Electrical insulation between the plates and the rails is provided by either creosoted timber or an asphalt filler. Protection against dragging brake rods or other equipment is furnished by inclined pressed-steel guards which cover the ends of the plates and are fastened to the ties. It is said that these plates can be removed and relaid easily when repairs to the roadbed are necessary, and that they can be inserted by the ordinary track gang.

New Section Motor Car

FAIRMONT Railway Motors, Inc., Fairmont, Minn., has recently developed a new 9 to 10-man standard section motor car, known as the "52," which is said to embody features that are not found in the other cars for such service that are put out by this company. One of these features is the flat deck which forms a continuous tool tray 69½ in. wide by 75 in. long, of which a space 24½ in. by 43 in. in size is occupied by the en-



The New Fairmont "52" Section Motor Car

gine enclosure. When the car is furnished with 16-in. wheels, as illustrated, the net inside tray space amounts to 24½ sq. ft.

The body unit of the car includes the deck, the seat and the safety railings and may be lifted off the underframe by loosening four bolts. This operation leaves the chassis in running condition, with all parts accessible for test or adjustment. The underframe consists of seven 3-in., 4.1-lb. structural steel channels with nine

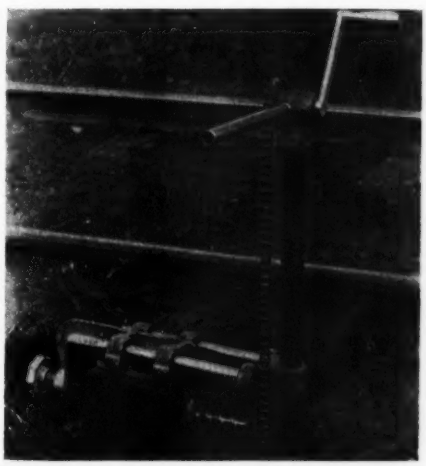
gusset plates. Twelve Timken bearings are used in the car, eight of which are for the four axle boxes, two in the belt controll pulley, and two on the engine crankshaft.

This car is powered with a 6 to 11-hp. engine of a type known as the "L." Although it is of a new design, the engine has the same bore and stroke and uses the same piston, piston pin, connecting rod and carburetor as the Fairmont "QB," thereby simplifying the matter of spare parts on roads having parts for the latter engine in stock. The cylinder head of the engine is removable without taking off the water jacket which is cast in one piece together with the cylinder and crankcase. The water jacket is guaranteed not to burst by freezing, as the automatic overflow obviates the possibility of filling the jacket too full. A screw plug in the top of the funnel protects passengers from drops of hot water.

A long starting crank with an outboard bearing is said to enable the operator to stand beside the car in an easy position and crank the engine in either direction, for running the car forward or backward, as desired. With the engine running, it is claimed that the car can be quickly reversed without cranking, by switching the ignition off and then on again just before the engine stops. Riveted wheels, 20 in. by ¼ in. in size, are standard equipment.

A Hand Tie-Boring Machine

A HAND machine for boring holes in ties in the track for the insertion of bolts to draw checks or splits together is now being marketed by Greenlee Bros. & Co., Rockford, Ill. This device is composed of a combination clamping and centering device that is fixed to the tie, and a vertical post at one end, to the top of which is fixed a crank and a handle for carrying and steadying



Boring a Tie With the New Machine

the machine. The power for turning the horizontal drill at the bottom of the post is transmitted through a chain and sprocket drive.

The machine is so constructed that it may be used in a tie space of not less than 10 in., and it will bore through ties not more than 10½ in. in thickness. Owing to the fact that it is possible to drill a hole only 6 in. in depth from one side of the tie, it was necessary, in the design of the device, to arrange for the accurate boring of holes from both sides of the tie. This was done by equipping the clamping device with a pointed screw on the side opposite the drill. In addition to clamping the machine securely to the tie this screw marks the point at which drilling should commence in order that the hole will be in line with that drilled from the other side.

That part of the device containing the drill has two arms which extend through bearings in the clamping device, and as the bit progresses into the tie these arms move forward through the bearings, thereby holding the drill in alinement. This device will handle bits up to one inch in diameter.

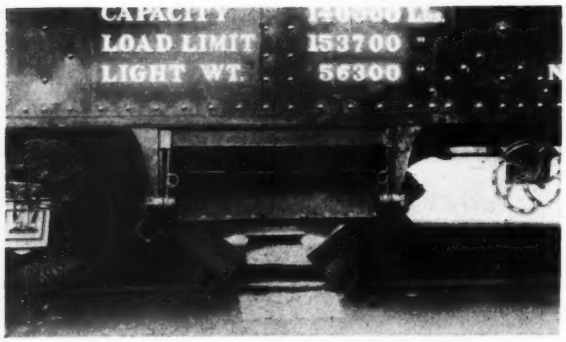
Ballasting Features Added to Standard Hopper Car

THE Magor Car Corporation, New York City, is now offering a special arrangement of bottom doors and side gates for standard hopper cars, which, without in any way affecting the use of these cars in regular revenue service, adapts them for maintenance of way ballasting work, with features of flow control and selective distribution. The new door and gate features, which the company is prepared to embody in new car construction, or to apply to existing hopper cars, replacing the usual type of door equipment, do not affect the weight or volumetric capacity of the cars, and, while designed to afford regulation of discharge, do not in any way restrict the bulk unloading of materials. Thus, cars embodying the new features are interchangeable between revenue and maintenance of way service without the necessity for making alterations or adjustments of any kind.

Essentially, the new design converts the lower part of each of the V-shaped hoppers of a standard car, with its hinged door opening, into a rectangular-shaped hopper with two balanced drop doors, and adds down-cut discharge gates on each side of the car, directly in line with the bottom openings. The rectangular-shaped hoppers of the new design, like the V-shaped hoppers of the standard car, are divided into two units by the center-sill construction of the car.

The new bottom doors are operated and controlled mechanically through shafting and gears, from the side of the car, in such a way that the flow of material is under control at all times and can be not only increased or decreased at will during dumping, but shut off entirely, if desired. The side gates in the new design provide wide and deep openings, the depth of which can be altered at will by the operator, even during the flow of material, and even to the extent of stopping the discharge of the material entirely. Through these features, which are said to in no way affect the use of the car for general service, ballast can be unloaded on to the track in the quantities desired at various points, from shoulder to shoulder at one time, on one or both shoulders alone as needed, or throughout the length of the ties alone.

The two bottom doors under each main hopper opening are of heavy steel-plate construction, reinforced on the bottom, and are provided with deep vertical flanges on the sides and rear to give them a tight seal when closed and to assist in confining the flow of the material laterally when opened. Each of the two doors is mounted on and keyed to a trunnion, transverse to the car, which brings the opposite doors end to end in a horizontal plane when closed, and inclined downward, away from each other, when opened. Operation of the doors in each case is by means of a hand wheel at the side of the car, which is connected mechanically to the door through two



A Close-Up of the Magor Door and Gate Arrangement, Showing the Door Operating Hand Wheels and One of the Side Gates in Fully Closed Position

lengths of shafting, a pair of bevel gears, and, immediately at the door trunnion, through a worm and gear segment. Through this mechanical arrangement, with all parts accessible and protected beneath the car, the doors are opened and closed easily, and yet, the loading on the doors and the gear ratio provided are such that the doors hold themselves rigidly when closed or at any degree of opening, regardless of the load upon them. Positive locking of the door-operating mechanisms, and thereby the doors themselves, can be effected by means of a ratchet and pawl, with a cam pawl keeper, provided directly at each hand wheel. Ease in shutting off or reducing the flow of material by closing the hopper openings has been effected through pivoting the doors near their transverse center line, wherein the weight of the material tending to force them open is counterbalanced in part by the weight of the material on the opposite side of the trunnion support. Only about 1½ min. is required to make a full opening or closure of all of the doors on a two-hopper car.

Ballast flowing from the bottom doors spreads over a width equal to the length of the ties, but is kept from flowing directly on the rails by means of deflectors of suitable shape, attached to the upper faces of the door plates, directly over the lines of rails. Distribution of the ballast is quite uniform on each side of each rail, except through the immediate center of the track, where, because of the center sill of the car, the distribution is considerably lighter. This is offset to some extent by the shape of the deflectors provided to keep the rails clear, which direct the ballast over a wider area between the rails than outside the rails.

The side gates, provided primarily for unloading ballast on to the track shoulders, consist in each case of a curved cast-steel segment, pivoted at each end, which, when in normal position, closes off an opening in the side of the hopper, directly alongside the bottom doors. The gate segment itself, which is provided with a tongue and groove arrangement on each side to prevent the leakage of fine material, is mounted in such manner that its own weight keeps it in a closed position, entirely within the side limits of the car body proper. The gate is opened upward and outward, rotating about its end bearings, by means of any suitable bar, such as any one of several types of track bars. The end of the bar is simply inserted in either of two sockets provided on the ends of the gate casting and the bar is used as a lever in throwing open or closing the gate.

Through the curved face of the gate and the position of the sockets, one man on the bar can open the gate readily, even when under full load pressure, and, assisted by the down-cut feature of the gate, he can also, with equal facility, regulate the size of the opening or stop the flow of material completely. The side gates distribute the ballast over a width up to 24 in., depending upon the degree of opening, from the ends of the ties out and thereby replenish the ballast on the shoulders only.

Through the means provided for controlling the door and gate openings, with the controls close together directly along the side of the car, ballast can be distributed over the width of the track proper and on one shoulder at the same time by one man. When ballasting both shoulders simultaneously, an additional man is required to operate the gate on the opposite side of the car.

Left—Unloading Ballast on the Shoulder from One of the Side Gates Right—Ballast Unloaded from Bottom Doors Only, Shown in the Foreground. Beyond, the Flow of Ballast was Cut Off Completely and then Resumed Over the Track and Both Shoulders

New Books

Wood-Preservers' Proceedings

PROCEEDINGS of the American Wood-Preservers' Association, 500 pages. 6 in. by 8½ in. Bound in cloth. Published by the Association, 1427 Eye street, N. W., Washington, D. C.

This volume of the proceedings is a report of the convention held at Philadelphia, Pa., on Jan. 27-29, and contains papers, committee reports, addresses, and discussions from the floor, dealing with current problems and activities of the wood preservation industry and those who use treated wood. Of particular interest in this year's volume are a committee report on bridge and structural timber, papers by R. S. Belcher and C. B. Musselman on the practices and results obtained with treated ties and timbers on the Santa Fe and the Lehigh Valley, respectively, and a paper by F. O. Dufour on the use of treated timber in construction.

A Battery of Tie Adzers in a Rail-Laying Operation

NEWS OF THE MONTH

Rock Island to Operate All-Expense Tours to Pacific Coast

An innovation in all-expense tours is to be introduced by the Chicago, Rock Island & Pacific in conjunction with the Southern Pacific on August 16 and 23 when it will operate two all-expense tours from Chicago to the Pacific coast and return. On these tours, the entire trip will be made by daylight, and overnight stops will be made at interesting points or mountain resorts. The cost of the tours, which will require 19 days, will be $154.15, with an additional $38 for meals.

Redwood Train of 125 Cars

A train consisting of 125 cars of redwood lumber and known as the Redwood Empire Special left Sacramento, Cal., on July 1 for eastern points. The train, which was also known as the Prosperity Special, was moved over the Southern Pacific, the Union Pacific and the Chicago & North Western to Chicago, and thence eastward over the Pennsylvania. About 25 cars were cut out at Omaha, Neb., and approximately 30 between the latter point and Chicago, while the remaining 70 continued to New York and other eastern cities.

Cooled Diners on the Pennsylvania

De luxe dining cars in which is circulated air purified and cooled to any desired temperature have recently been placed in service by the Pennsylvania on some of its important passenger trains. Tests have shown the possibility of maintaining a temperature of 76 deg. F. in the cars with an outside temperature of 100 deg. or more, and under actual service conditions the interior of the cars may be kept at a temperature 12 deg. lower than that on the outside. The cars are insulated against low as well as high temperatures.

To Construct Dotsero Cutoff

The Denver & Rio Grande Western has filed with the Interstate Commerce Commission acceptance of that body's conditions in regard to this road's application for permission to acquire the Denver & Salt Lake, and in so doing agrees to undertake construction of the Dotsero cutoff, a proposed 41-mile line between Orestod, Colo., on the D. & S. L. and Dotsero on the D. & R. G. W. Through its acquisition of the D. & S. L., on which is located the Moffet tunnel, and the construction of the cutoff, the D. & R. G. W. will effect a material reduction in th mileage of its route between Denver, Colo., and the Pacific coast. It is expected that operation over the new line will be commenced by the end of 1932.

Rates to Meet Truck Competition Authorized by I. C. C.

The Interstate Commerce Commission has authorized the New York, New Haven & Hartford to place in effect on short notice rates of 35 cents per 100 lb. on all commodities named in the official classification with a few exceptions between Boston, Mass., and New York Pier No. 37, East River, in order to meet the competition of trucks. The new rates supersede rates ranging from 40 to 66 cents a 100 lb. The Northwestern roads have applied to the commission for authority to establish a 20-cent station-to-station freight rate between Seattle, Wash., and Portland, Ore., for an experimental period ending with 1931, also to meet truck competition. The new rates would apply to all commodities with the exception of a few not susceptible to truck transportation.

Southern Pacific Employees in Campaign Against Trucks

A vigorous campaign against unrestricted and unregulated highway transportation service has been instituted by the employees of the Southern Pacific in an effort to win traffic back to the railroads. These employees have started numerous "Railroad Family Clubs," and an organization known as the "Southern Pacific Club" and composed of 3,000 members has been organized at the general offices at San Francisco, Cal., to further the campaign. Merchants and business men are invited to attend meetings of employees at which addresses are given by speakers sympathetic to the railroad cause. The principle of reciprocity, in which it is expected that merchants ship by rail in return for railroad employee patronage, is stressed at these meetings, which are supplemented by local newspaper advertisements. When buying from local merchants, employees hand out cards stating that the employee can continue to buy only so long as the railroad requires his services.

Rock Island to Use More Oil Locomotives

Immediate conversion of 231 additional locomotives used on its lines south and southwest of Kansas City, Mo., from coal burning to oil burning is being undertaken by the Chicago, Rock Island & Pacific. It is expected that this step will result in substantial economies in operation in view of the present low prices of fuel oil. This undertaking will involve the construction of 13 roadside stations for fuel oil, and considerable work incident to the conversion of the locomotives to the use of liquid fuel, which is being done in the shops of the Rock Island. The Rock Island has operated oil-burning locomotives on a considerable mileage of its lines for a number of years.

Passengers Per Pullman Car Show Increase

A marked increase in the number of passengers carried per Pullman car on recent week ends, as compared with last year, has been the result of reduced rates offered by this company. From April 11 to July 12 this year, 10,029 passengers traveled at Pullman excursion rates in 349 cars, or an average of 28.8 per car, as compared with 10.57 to each car in 1930. One 16-section car, operated between St. Paul, Minn., and International Falls, on July 3 and 4, carried 42 passengers, and 21 cars operated on the same date carried an average of 29.2 passengers per car. During June, the sale of single occupancy sections in Pullman cars totaled 62,460, as compared with 36,829 in June, 1930, an increase of about 85 per cent.

Record Grain Loadings

The peak of the grain movement in the Southwest has now passed, leaving at least one road with record figures for the number of cars of grain loaded in one day. This is the Atchison, Topeka & Santa Fe, which set a high record of 2,723 cars loaded on July 8, as compared with the previous record of 2,149 cars,

which was established on July 13, 1929. Other days of heavy grain loadings this year, all of which surpassed the former record, were as follows: June 30, 2,568 cars; July 1, 2,436; July 7, 2,424; and July 9, 2,576. During the five days from July 7 to 11 inclusive, the Santa Fe loaded 12,292 cars of grain, or an average of 2,458 cars per day, which is the longest sustained heavy loading of grain that this road has experienced. On the Chicago, Rock Island & Pacific from June 15 to July 11, the grain loading totaled 14,667 cars, as compared with 12,030 cars in the same period of 1930. The largest single day's loading was on July 11, with 1,149 cars.

Third Quarter Car Loadings Expected to be 9.3 Per Cent Lower

Carload shipments of the 29 principal commodities in the third quarter of the year will total approximately 7,082,186 cars, a reduction of 724,851 cars, or 9.3 per cent, below the corresponding period in 1930, according to estimates submitted to the Shippers' Regional Advisory Boards. It is estimated that increases will occur in the shipments of citrus fruits, other fresh fruits, potatoes, other fresh vegetables and petroleum and petroleum products, while shipment of the remaining 24 principal commodities will show decreases as compared with last year.

Great Northern Beats Patent Infringement Suit

A patent infringement suit against the Great Northern, in which engineers claimed that they held patents on the pioneer method of drilling tunnels which this road used in the construction of its Cascade tunnel, was decided in favor of the road by the U. S. District Court at Spokane, Wash., on July 16. Damages of approximately $1,000,000 were asked. The pioneer method involves the construction of a small tunnel parallel to the main bore for the purpose of facilitating the work. The railway claimed that this method was known and used before the patent was obtained, which contention was upheld by the court.

Class I Roads Have Five-Months Net of 2.10 Per Cent

For the first five months of 1931, the Class I railroads of the United States had a net railway operating income of $188,387,587, which was at the annual rate of return of 2.01 per cent on their property investment, as compared with an income of $308,216,627, or 3.5 per cent, in the first five months of 1930. Total operating revenues for the five months amounted to $1,817,627,035, as compared with $2,247,304,488 for the same period in 1930, a decrease of 19.1 per cent. Operating expenses totaled $1,436,628,824, as against $1,739,226,923 last year, a decrease of 17.4 per cent. Railway taxes in the five-month period amounted to $137,246,366, as compared with $149,194,861 for the same period in 1930, a decrease of 8 per cent. Forty-four of the 171 Class I roads operated at a loss in the first five months. For the month of May, these roads had a net income of $41,263,621, a return of 2.03 per cent, while in May, 1930, the net income was $69,322,585, a return of 3.48 per cent.

District Court Fails to Block New Grain Rates

The temporary order restraining the Interstate Commerce Commission from placing in effect for a period of 60 days its order revising rates on grain and grain products, which was granted the Western railroads by the United States District Court at Chicago on May 7, was dissolved by this court on June 30. The court also denied the carriers' application for a temporary or interlocutory injunction against the commission's grain rate order. In its decision, the court stated that the railroads had failed to prove that the new rates were unwarranted and unreasonable, adding that the Interstate Commerce Commission acted entirely within the law in prescribing them. On July 3, following the issuance of the court order, I. C. C. ordered the rates into effect on August 1. At a meeting at Chicago on July 2, the presidents of the Western railroads decided that the decision of the District court would be appealed to the United States Supreme court. It is estimated by the Western roads that their revenues will be reduced by $20,000,000 a year if the new rates on grain and grain products are placed in effect.

Commence Hearings on Proposed Rate Increase

Hearings on the application of the railroads of the United States for a horizontal increase of 15 per cent in their freight rates, which was filed with the Interstate Commerce Commission on June 16, were commenced at Washington, D. C., on July 15, when the railroads and their supporters were given an opportunity to present evidence and arguments in favor of the increase. Evidence supporting the increase has been presented by Dr. Julius H. Parmelee, director of the Bureau of Railway Economics, R. H. Aishton, president of the American Railway Association, a number of railroad presidents, and representatives of the Emergency Committee on Railroad Investments of Life Insurance Companies and Mutual Savings Banks and the Security Holders' Committee on the Railroad Emergency. The purpose of a majority of the evidence has been to bring out the plight of the railroads and to show the disastrous effect that the situation will have on their credit if relief is not granted. Originally the commission announced that hearings at which opponents of the increase would be given an opportunity to present their side of the question would commence on August 31, but subsequently the date was moved up to August 4. Hearings are to be held at San Francisco, Cal., Chicago, Portland, Ore., Kansas City, Mo., Dallas, Tex., Salt Lake City, Utah, Atlanta, Ga., and at a point in New England.

ASSOCIATION NEWS

American Railway Engineering Association

During July only a few general meetings of committees were held, these activities being confined largely to the subcommittees, which held numerous meetings. Among the committees that met during the month were those on Buildings at Cleveland, Ohio, on July 7 and 8; on Maintenance of Way Work Equipment at Chicago on July 14; and on Track at Chicago on July 22. So far, only one committee has scheduled a meeting for August—the Economics of Railway Operation, at Toronto, Ont., on August 13 and 14.

Bridge and Building Association

In response to a suggestion from the Conference of Railway Presidents, the members of the Executive committee of the American Railway Bridge & Building Association voted, at a meeting at Chicago on July 25, to transfer the convention from Toronto, Ont., to Chicago, and to curtail the sessions to two days. It is expected also that the customary exhibit of the Bridge and Building Supply Men's Association will be eliminated. Through the addition of a business session on Tuesday evening, it is expected that ample time will be afforded for the full consideration of reports and the transaction of all necessary business. The convention was transferred to Chicago to make it possible for a larger number of members and other interested railway men to attend the session with the minimum loss of time and expense.

International Track Supervisors' Club

The next meeting of the International Track Supervisors' Club will be held at the General Brock Hotel, Niagara Falls, Ontario, on August 13. Following luncheon, which will be served at 1 p. m., Daylight Saving Time, papers on phases of track maintenance will be presented by M. W. Feeney, supervisor on the New York Central at Rochester, N. Y., and J. P. Sexton, supervisor on the same road at Lackawanna, N. Y.

The Roadmasters Association

Every effort is being exerted to make the forty-ninth annual convention at the Hotel Stevens, Chicago, on September 22-4, a "brass tacks" convention. The program, which is rapidly assuming shape, includes, in addition to the reports of the five standing committees, addresses by five railway men of outstanding reputation on problems of the day. In addition to the regular sessions,

a program is being developed for Tuesday evening, having for its theme the general topic of Cutting Costs. This meeting will be addressed by officers of roads which have achieved special success in this direction. An innovation will be introduced this year in the form of a "question box", for which provision has been made on the program on Wednesday afternoon. At this session, opportunity will be afforded members to present problems confronting them and to benefit from the experience of others in their solution.

Trade Publications

Paved Invert Pipe.—The Armco Culvert Manufacturers' Association has issued catalog No. 3 entitled, "Armco Paved Invert Pipe—The Pipe of Balanced Design," which deals with the practice of paving Armco pipe with asphalt to prevent erosion.

Weldless Coil Chain.—The American Chain Company, Bridgeport, Conn., has issued a 32-page catalogue describing and illustrating its complete line of ACCO weldless coil chain and attachments. All illustrations in the catalogue are full size.

Sizes We Roll and Standard Extras—This is the name of a vest pocket booklet of 48 pages issued by the Inland Steel Company, Chicago. For convenience, all standard extras and differentials applying to bars, plates, structurals, and rail steel products have been included as well as a complete list of sizes rolled.

Air Compressors.—The Gardner-Denver Company, Quincy, Ill., has issued a new 32-page bulletin, PC4, illustrating and describing the various sizes and mountings of its portable compressor line. Engineering features such as force feed lubrication with filtered oil, bearing areas, and the automatic control system are fully described.

Air Compressors Under Test—The Davey Compressor Company, Inc., Kent, Ohio, has issued a 16-page booklet entitled "Four Air Compressors Went to School," which gives the results of extensive and strenuous tests conducted on four air compressors, one a Davey compressor and the other three of different makes. The booklet contains many illustrations.

New C. B. Sections.—The Carnegie Steel Company has issued an abridged edition of its Pocket Companion for the purpose of presenting, as quickly as possible, the properties of the revised C. B. or wide-flange beams. This revision is the result of an agreement reached by the Bethlehem Steel Corporation, the Carnegie Steel Company and the Illinois Steel Company, in the interest of standardization, whereby the wide flange sections of these three companies have been modified so as to make them as nearly interchangeable as mill conditions and economical operation will permit.

PERSONAL MENTION

General

John M. Fitzgerald, assistant to the chairman of the Committee on Public Relations of the Eastern Railroads, and formerly president of the Western Maryland, whose railway career comprises experience in the engineering, construction, maintenance and operating departments, has been appointed vice-chairman with headquarters as before at New York.

Clarence E. Weaver, chief engineer of the Central of Georgia with headquarters at Savannah, Ga., has been appointed assistant general manager and chief engineer, a newly created position, with the same headquarters. Mr. Weaver was born in Newark, N. J., on January 7,

Clarence E. Weaver

1877, and was educated at Woodstock Academy (Woodstock, Conn., and the Sheffield Scientific School of Yale University. Following graduation, he entered railroad service in 1899 as assistant engineer on the Mexican International (now part of the National of Mexico), in which capacity he served until 1906, when he became resident engineer for the Sonora Railway (now part of the Southern Pacific of Mexico). He was also appointed resident engineer of the Cananea, Yaqui River & Pacific (now part of the S. P. of Mexico), in 1908, and the following year he became engineer maintenance of way, of the Sonora Railway and the Southern Pacific of Mexico. From March to June, 1911, Mr. Weaver was resident engineer on construction for the Illinois Central, then becoming roadmaster for the same road, in which capacity he served until 1913. On the latter date he was appointed chief district engineer on the Southern lines of that company. He was appointed engineer maintenance of way of the Central of Georgia in 1916, and in 1926 was promoted to chief engineer, which position he will continue to hold, in addition to that of assistant general manager.

Engineering

The headquarters of **Heron Cabrera,** chief engineer of the National of Mexico, were transferred to Buenavista station, Mexico, D. F., on July 1.

R. H. Crew, division engineer of the Akron division of the Pennsylvania, with headquarters at Akron, Ohio, has been transferred to the office of the chief engineer at Philadelphia, Pa., succeeding **C. J. Code,** who has been transferred to the Renovo division, with headquarters at Erie, Pa., to replace **W. T. Hanley,** deceased.

J. R. Caswell, division engineer of the Canadian Pacific at Smiths Falls, Ont., has been transferred to the Montreal terminals, with headquarters at Montreal, Que., succeeding **J. A. MacKenzie,** transferred. **W. W. Benny,** formerly division engineer at Ottawa, will replace Mr. Caswell as division engineer at Smiths Falls.

Manuel Salazar Arce, division engineer of the Chihuahua division of the National of Mexico at Chihuahua, Chih., has been transferred to the Pacific division, with headquarters at Acambaro, Gto., succeeding **Augustin Polanco,** who has been transferred to the Jalapa division, with headquarters at Jalapa, Ver. C.

S. R. Young, assistant chief engineer of the Atlanta & West Point, has been appointed chief engineer of that road, the Western Railway of Alabama and the Georgia Railroad, with headquarters as before at Atlanta, Ga. Mr. Young succeeds **O. T. Nelson,** whose death is noted elsewhere in these columns.

Mr. Young was born on March 3, 1887, at Coatesville, Pa., and studied civil engineering at Lehigh University, graduating in 1909. He received his first railroad experience during the summer of 1902, as messenger boy in the car

S. R. Young

record office of the Pennsylvania, at Philadelphia. He reentered the service of the Pennsylvania in 1910, as rodman on the Sunbury division of the Pennsylvania, continuing in that capacity until 1912, when he undertook other work. In May, 1916, he again became engaged in railroad work as assistant engineer of the Atlanta & West Point, the Western Railway of Alabama, and the Georgia,

and from January to December, 1918, he served as division engineer of the Georgia. In December, 1918, he became district engineer of the three railroads mentioned above, and from December, 1919, to March, 1920, served only with the Georgia, as district engineer. On March 1, 1920, he was appointed assistant chief engineer of the three railroads, which position he held until his recent promotion.

Morris S. Blaiklock, assistant chief engineer of the Canadian National, with headquarters at Montreal, Que., has retired after more than half a century with this company, but will continue to act as chairman of the General Co-operative Committee of Maintenance of Way employees. Mr. Blaiklock entered the service of the Canadian National in 1880,

Morris S. Blaiklock

when he joined the engineering staff as a draftsman. In the fall of 1890, he was appointed resident engineer on the construction of the St. Clair tunnel at Sarnia, Ont., continuing there until 1893, when he became inspector of operation at Montreal. In 1897, he was appointed resident engineer of the Eastern district at Montreal, and in 1902 he became superintendent. Mr. Blaiklock was appointed engineer maintenance of way in 1907, and in 1923 he was appointed assistant chief engineer, which position he held until his retirement.

Coincident with the transfer of the executive offices of the Erie from New York to Cleveland, Ohio, the following engineering officers have established their headquarters at the latter point: **R. C. Falconer,** assistant vice-president in charge of engineering work; **G. S.** Fanning, chief engineer; **A. W. Miesse,** assistant to chief engineer, **J. C. Patterson,** chief engineer maintenance of way; **J. W. Smith,** principal assistant engineer; **F. A. Howard,** engineer of structures; **A. M. Knowles,** assistant engineer of structures, **O. V. Deer,** valuation engineer; **H. J. Stroebel,** assistant valuation engineer; **C. H. Splitstone,** superintendent of construction; **E. T. Johnson,** special engineer; **H. F. King,** special engineer; **W. J. Foster,** engineer of grade crossings; **W. R. Marshall,** assistant engineer of grade crossings; **S. H. Doe,** office engineer and **W. H. Brameld,** office assistant. **E. H. Ness,** supervisor of work equipment and welding, **W. J. Donlevy,** supervisor of materials, and **R. America,** general scale inspector, have also been transferred to Cleveland.

Following the consolidation of the Beaumont and Galveston divisions of the Gulf, Colorado & Santa Fe into one division, known as the Gulf division, **S. W. Brady,** division engineer of the Beaumont division, has been appointed division engineer of the Gulf division, with headquarters as before at Beaumont, Tex. **Z. A. Green,** division engineer of the Galveston division, with headquarters at Galveston, Tex., has been transferred to the Southern division, with headquarters at Temple, Tex., succeeding **J. L. Starkie,** who has been appointed office engineer at Galveston to replace **G. L. Marick,** who has been appointed assistant office engineer, with the same headquarters.

J. S. McBride, valuation engineer of the Chicago & Eastern Illinois, has been promoted to chief engineer, with headquarters as before at Chicago, to succeed **L. C. Hartley,** who has retired on account of ill health. The position of valuation engineer has been abolished and the duties assumed by the chief engineer.

Mr. McBride has been associated with the engineering department of the C. & E. I. for more than 26 years. He was born on November 4, 1880, at Louisville, Ky., and graduated from Rose Polytechnic Institute in 1905, with a degree in civil engineering. He entered the service of the C. & E. I. in June of the same year as resident engineer on construction, and from January, 1906, to April, 1908, he served in various positions in the engineering department, being on the latter date appointed assistant engineer on

L. C. Hartley

maintenance and construction. In April, 1914, Mr. McBride was advanced to valuation engineer and two years later he was appointed principal assistant engineer, in which capacity he retained jurisdiction over valuation matters. In 1919, he resumed the position of valuation engineer and served in this capacity until his recent promotion to chief engineer, effective June 15.

Mr. Hartley has occupied various positions in the signal and engineering departments of this road for 31 years. He was born at Masontown, W. Va., on December 29, 1871, and was educated at Ohio State University. His first railway service was with the signal department of the Pittsburgh, Cincinnati, Chicago & St. Louis (now part of the Pennsylvania) in 1898. In 1900, he went with the C. & E. I. as assistant on the engineering corps, being appointed assistant engineer in 1904. Three years later he was promoted to signal engineer and in 1910 he was further promoted to engineer maintenance of way. Mr. Hartley became chief engineer in the following year and held this position continuously until his retirement, which became effective June 15. From 1917 until his retirement, except during the period of Federal control of the railroads, he served also as chief engineer of the Southern Illinois & Missouri Company, which owns and operates the bridge over the Mississippi river near Thebes, Ill. During Federal control of the roads, Mr. Hartley was also chief engineer of the Chicago, Terre Haute & Southeastern (now part of the Chicago, Milwaukee, St. Paul & Pacific), and of the Evansville & Indianapolis (now part of the Cleveland, Cincinnati, Chicago & St. Louis). In 1928, he was also made chief engineer of the Chicago Heights Terminal Transfer Railroad.

Track

Warren F. Hart has been appointed roadmaster on the Union Pacific, with headquarters at Columbus, Neb., succeeding **J. R. Van Buskirk.**

P. I. Buser has been appointed roadmaster on the Chicago, Rock Island & Pacific, with headquarters at Cameron, Mo., succeeding **D. Kanan,** who has retired.

J. M. Jackson, supervisor of track on the Illinois Central, with headquarters at Covington, Tenn., has been transferred to Durant, Miss., succeeding **I. D. Holmes,** who in turn has been transferred to Covington.

J. R. MacAsy, general roadmaster and safety supervisor on the Erie, with headquarters at New York, has been transferred to Cleveland, Ohio, along with the large number of engineering and maintenance officers noted elsewhere in these columns.

A. J. Warren has been appointed roadmaster on the Canadian Pacific, with headquarters at Mattawa, Ont., succeeding **W. H. A. Gunning,** who replaces **E. McCrea** as roadmaster at the same point. Mr. McCrea has been transferred to Schreiber, Ont., where he succeeds **James Coughlin.**

H. Fisher, assistant engineer on the Dallas division of the Southern Pacific Lines in Texas and Louisiana, with headquarters at Ennis, Tex., has been promoted to roadmaster, with headquarters at the same point, to succeed **C. B. Arnold,** who has been assigned to other duties. **John Hitt,** maintenance of way in-

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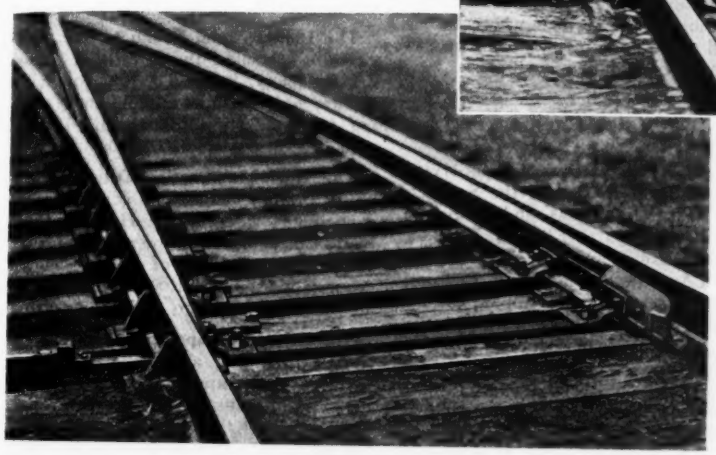

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spector of the Texas and Louisiana lines, with headquarters at Houston, Tex., has retired after more than 26 years' service with this road.

F. M. Oyler, supervisor of track on the Pittsburgh division of the Central Region of the Pennsylvania, with headquarters at Gallitzin, Pa., has been transferred to the Buffalo division, with headquarters at Dunkirk, N. Y., succeeding **Fred Lundberg.** As noted in the July issue, **R. L. Chaney,** supervisor at Dennison, Ohio, succeeds Mr. Oyler at Gallitzin.

John B. Armstrong, track foreman on the Canadian National, with headquarters at Sussex, N. B., has been appointed acting roadmaster at Moncton, N. B., to succeed **F. P. Doyle,** deceased. **F. Serviss,** roadmaster, with headquarters at Coteau, Que., has been transferred to Cornwall, Ont., succeeding **W. Bibby,** deceased. **J. A. Melanson,** track foreman, has been appointed acting roadmaster, with headquarters as before at Moncton, to replace **C. W. Palmer,** also deceased.

Bridge and Building

C. E. Morrow, assistant engineer on the Missouri-Illinois, has been appointed supervisor of bridges and buildings, with headquarters at Bonne Terre, Mo.

F. M. Bigelow, supervisor of bridges and buildings on the Los Angeles & Salt Lake, with headquarters at Los Angeles, Cal., who has been on a leave of absence, has retired after 43 years service with this road. As announced in the May issue, the position of supervisor of bridges and buildings at Los Angeles has been abolished.

C. N. Billings, whose promotion to supervisor of bridges and buildings of the Victoria division of the Southern Pacific Lines in Texas and Louisiana was noted in the June issue, graduated from the University of Washington in 1923 with a degree in civil engineering. From 1915 to 1923, during vacations from school, Mr. Billings served as rodman and draftsman on the Portland division of the Southern Pacific. Immediately following his graduation he became an instrumentman on the Lafayette division of the Texas and Louisiana lines, being promoted to resident engineer on the Rio Grande Valley extension of the S. P. in 1926. During May and June of 1927, Mr. Billings was on special flood control work in Louisiana, and in July of the same year he was appointed assistant division engineer of the Beaumont division, which position he was holding at the time of his recent promotion to supervisor of bridges and buildings, with headquarters at Victoria, Tex.

E. R. Tattershall, whose promotion to supervisor of structures on the Electric division of the New York Central, with headquarters at New York City, was noted in the June issue, began his railroad career on June 20, 1906, as a rodman on the Pennsylvania division, and on June 18, 1907, was promoted to transitman on the River division, with headquarters at Weehawken, N. J. On August 1, 1908, he was promoted to assistant supervisor of bridges and buildings, with the same headquarters, and on November 5, 1912, he was promoted to supervisor of bridges and buildings on the Adirondack division, with headquarters at Malone, N. Y. On July 16, 1925, Mr. Tattershall was promoted to supervisor of piers and buildings on the Hudson division, with headquarters at New York City, and on May 1, 1926, he was promoted to division engineer on the St. Lawrence division, with headquarters at Watertown, N. Y. On July 1, 1930, he was appointed supervisor of bridges and buildings on the Adirondack division, with headquarters, as before, at Malone, where he was located at the time of his recent promotion to supervisor of structures.

Water Service

J. E. Marshall, water service supervisor of the El Paso division of the Southern Pacific Lines in Texas and Louisiana, with headquarters at El Paso, Tex., has had his jurisdiction extended to include the San Antonio division. **B. F. Pennington,** water service supervisor on the latter division, has been assigned to other duties. **J. D. Dodgen,** inspector of water and fuel service, with headquarters at Houston, Tex., has been appointed water service supervisor with jurisdiction over the Houston and Dallas divisions, succeeding **A. M. Finn** and **N. A. Hammack,** respectively, who have been assigned to other duties.

Obituary

O. T. Nelson, chief engineer of the Atlanta & West Point Railway, as well as of the Western Railway of Alabama and the Georgia Railroad, who died at Montgomery, Ala., on May 20, at the age of 73, had been in railway service continuously for 57 years. For the past 30 years he had served continuously with the Atlanta & West Point Railway. Mr. Nelson started his railroad career as an apprentice foreman on the Mobile division of the Mobile & Ohio in 1874, and from that time until 1901, he held various positions in the engineering and construction departments of several roads, now parts of the Southern Railway System, principally the East Tennessee, Virginia & Georgia, and the New Orleans & Northeastern, when these roads were being constructed. In February, 1901, Mr. Nelson gave up a position as roadmaster on the Southern, at Selma, Ala., to become a roadmaster on the Atlanta & West Point, his first connection with that road. Some time later he was appointed superintendent maintenance of way for the West Point route, now a part of the Atlanta & West Point, and at the same time served in the same capacity for the Georgia Railroad. During Federal control, and until May, 1920, Mr. Nelson served as engineer maintenance of way of the Atlanta & West Point, the Western Railway of Alabama and the Georgia Railway, when he was promoted to chief engineer of these roads.

SUPPLY TRADE NEWS

General

The Cement-Gun Construction Company has moved its New York office from the Grand Central Terminal to the Woolworth building, New York City.

The Liquid Metal Products, Inc., Chicago, has licensed the **Charles R. Long, Jr., Company,** Louisville, Ky., to manufacture and distribute a liquid metal coating for application to galvanized metal as a protection against corrosion.

The Buckeye Traction Ditcher Company, Findlay, Ohio, has concluded arrangements whereby the **Hopkins Company,** Chicago, will represent the former company in the sale of the Model OB crane and shovel in the railway field at Cleveland, Chicago and St. Louis.

The Puritan Compressed Gas Corporation, 2112 Grand avenue, Kansas City, Mo., has been appointed distributor in the state of Kansas and the western part of Missouri of the Weldite line of welding rods for the **Fusion Welding Corporation,** Chicago.

The Hackmann Railway Supply Company, Chicago, has acquired all patents and manufacturing and distributing rights covering Hackmann trackliners and other devices, in addition to certain other rights formerly held by the **Hackmann Trackliner Company,** which is now succeeded by the former company.

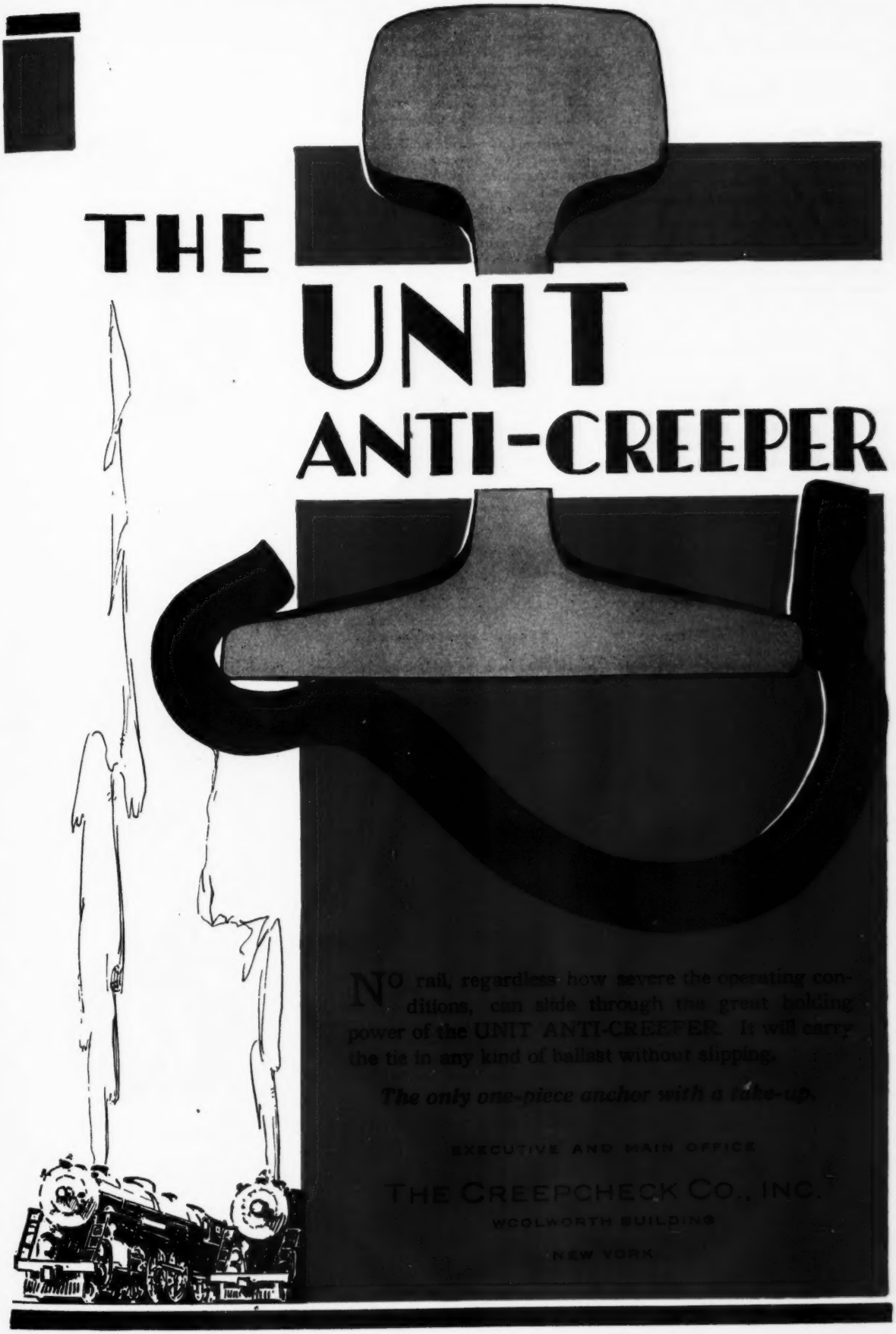
The DeVilbiss Company, Toledo, Ohio, has changed the location of its St. Louis, Mo., sales and service branch from 1903 Washington avenue to 1937 Washington avenue, and has also moved its New York sales and service branch from 25 West Forty-third street to 25 West Forty-fifth street.

The Inland Steel Company, Chicago, has added steel sheet piling to its line of rolled steel products. Two sections have been placed on the market and others are to be added to the line in the near future. One of the new Inland sections is designed for heavy pressures and the other for hard driving.

The Northwest Engineering Company has developed and is now installing on its larger engines a new type of carburetor and hand idling control which is said to assure power particularly at low speeds in hard pulling, more responsive throttle opening, steady operation at part throttle and governor idle speeds, and marked fuel economy.

E. G. Grace, president of the **Bethlehem Steel Corporation,** has announced the acquisition by Bethlehem of the properties and business of **Kalman Steel Company,** subject to the approval of the stockholders of the latter. Kalman

THE UNIT ANTI-CREEPER



NO rail, regardless how severe the operating conditions, can slide through the great holding power of the UNIT ANTI-CREEPER. It will carry the tie in any kind of ballast without slipping.

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Personal

Leslie Allen, formerly manager of the Buffalo district of **McClintic-Marshall Corporation,** has been appointed district manager of the Pittsburgh district, succeeding the late **Thomas L. Cannon.**

Roger W. Andrews, assistant to the president of **Blaw-Knox Company,** Pittsburgh, Pa., has been appointed vice-president and a director of the **Blaw-Knox International Corporation.** Mr. Andrews will be in charge of this company's European activities and will reside in Paris. He succeeds **C. T. Clack,** who died recently at Dusseldorf, Germany.

C. N. Johns has been appointed general manager of the **Page Steel & Wire Company,** with headquarters at Monessen, Pa., and **W. H. Bleecker, Jr.,** has been appointed sales manager, with headquarters at 701 American Bank building, Pittsburgh.

Edward J. Mehren, vice-president of the McGraw-Hill Publishing Company at Chicago, has been elected president of the **Portland Cement Association,** Chicago, effective September 1. By the election of a president from outside the cement industry who will devote his entire time to the position, the Portland Cement Association departs from its former practice of selecting as its head a president of one of the cement companies. Mr. Mehren has been engaged in the business publishing field for about 25 years. He was born in Chicago on August 5, 1881, and obtained his academic and technical training in engineering at St. Ignatius College and the University of Illinois. He obtained his first

Edward J. Mehren

practical experience in 1906, as a member of the engineering corps of the Chicago, Milwaukee & St. Paul on its Puget Sound extension. In the following year he became an associate editor of Engineering Record at New York, where he remained until 1911, when he was appointed secretary and manager of the Emerson Company, efficiency engineers. Mr. Mehren was appointed editor of Engineering Record in 1912 and when that publication was consolidated with the Engineering News in 1918 he became editor of the combined magazine. In 1921, he was appointed vice-president of the McGraw-Hill Publishing Company at New York, being transferred to Chicago in 1928.

William Lawrence Saunders, chairman of the board of directors of the Ingersoll-Rand Company, New York, died on June 25, at Teneriffe, Canary Islands. He was born on November 1, 1856, at Columbus, Ga., and graduated from the University of Pennsylvania in 1876 with the degree of B.S., being given the degree of Sc.D. by the same university in 1911. From 1876 to 1878, Mr. Saunders engaged in newspaper

William Lawrence Saunders

work, and on the latter date became engineer in charge of dock construction at Black Tom Island, New York Harbor. While serving in this capacity he designed and patented apparatus for subaqueous drilling, using tube and water jet systems which are now in general use. In 1882, he was appointed engineer for the Ingersoll Rock Drill Company and subsequently served as secretary, vice-president and director of the Ingersoll-Sergeant Drill Company; as president and director of the Rand Drill Company; and then as president of the successor company, the Ingersoll-Rand Company, until his election as chairman of the board. He was also a director of this company.

L. A. Paddock, operating vice-president of the American Bridge Company, at Pittsburgh, Pa., has been elected president, with headquarters at Pittsburgh, succeeding **Joshua A. Hatfield,** who died on July 4 at the Presbyterian Hospital, New York. **Arthur L. Davis,** general contracting engineer at New York, who has been with the American Bridge Company in its contracting department since its formation, has been elected vice-president in charge of sales, with headquarters at Pittsburgh.

Mr. Paddock, who was born on February 20, 1879, at Pontiac, Mich., received his higher education at the University of Michigan, from which he was graduated with the degree of bachelor of science in civil engineering. He began his engineering career in 1904, as a draftsman with the Canadian Bridge Company, Ltd., Walkerville, Ont., and subsequently became superintendent, vice-president and general manager, and president of this company. He was appointed president in 1924, and held that position until he was appointed vice-

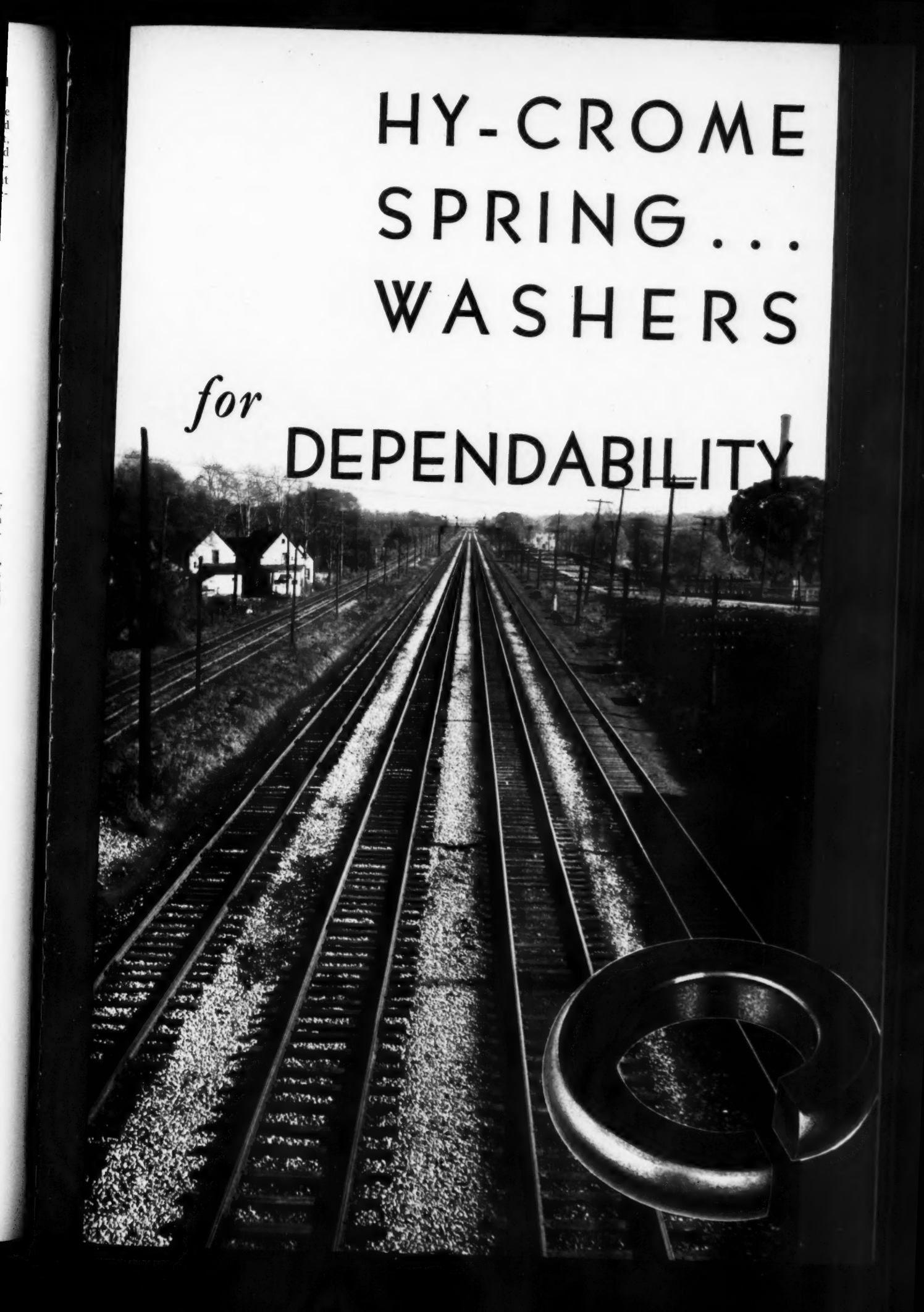
L. A. Paddock

president of the American Bridge Company in 1927. In addition to his new position as president of the American Bridge Company, Mr. Paddock is a director of that company.

Mr. Hatfield was born on June 11, 1863, at Philadelphia, Pa. He received his early education at private schools and from tutors and graduated from the Hill School at Pottstown, Pa., in 1880. The same year he entered the employ of the Pottstown Iron Company where he remained for 16 years, during the last five of which he held the position of general sales agent. From 1896 to May, 1900, he was associated as an executive with the A. & P. Roberts Company, Pencoyd Iron Works, Philadelphia, and in 1900 was appointed assistant to the president of the American Bridge Company. Mr. Hatfield

Joshua A. Hatfield

had served as a director of the American Bridge Company since 1900 and until 1914 was president of the American Bridge Company of New York, which was consolidated with the American Bridge Company of New Jersey, the present company, of which Mr. Hatfield became vice-president and was elected president in April, 1927.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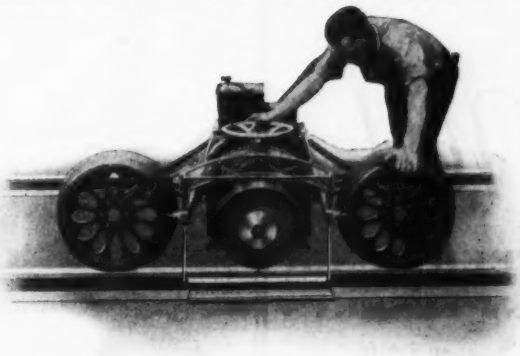
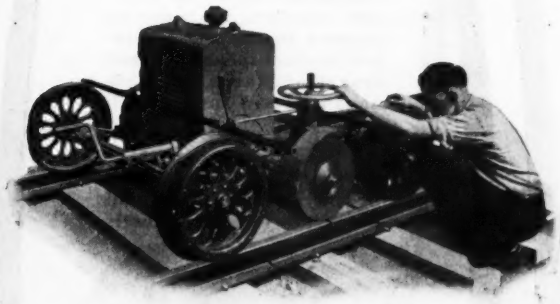
Model P-3 grinds one rail joint at a time, pivots to grind the opposite rail. Electric motor powered.

Model P-2 has two grinding heads working independently on opposite rails. Electric motor powered.

Model P-4 is gasoline engine powered.



Model P-3



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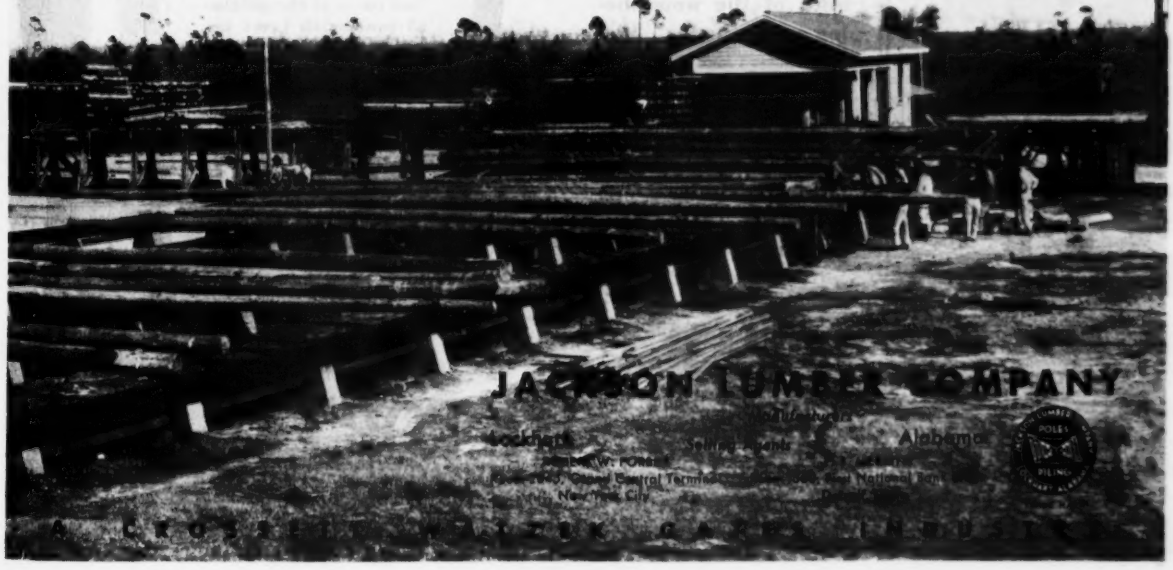

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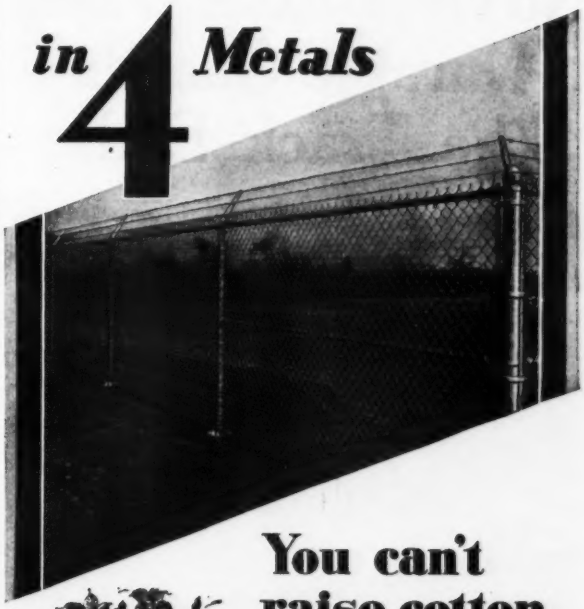

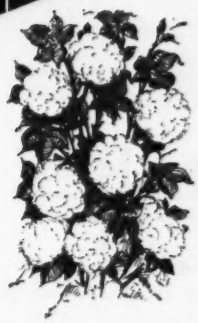

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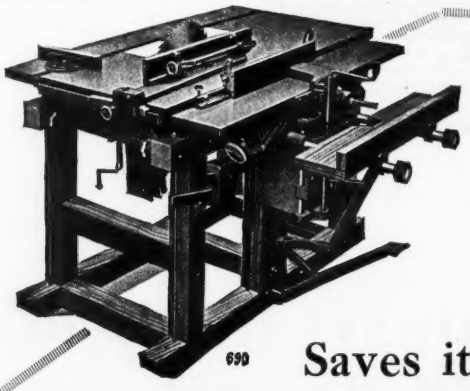

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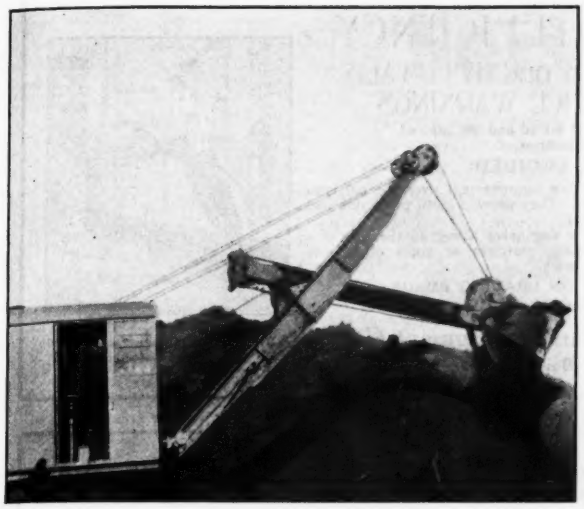

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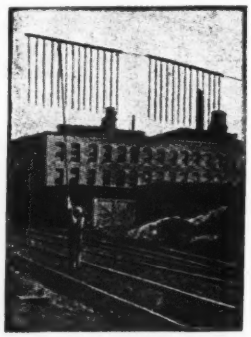

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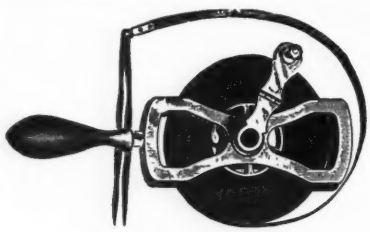

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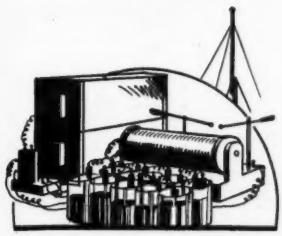

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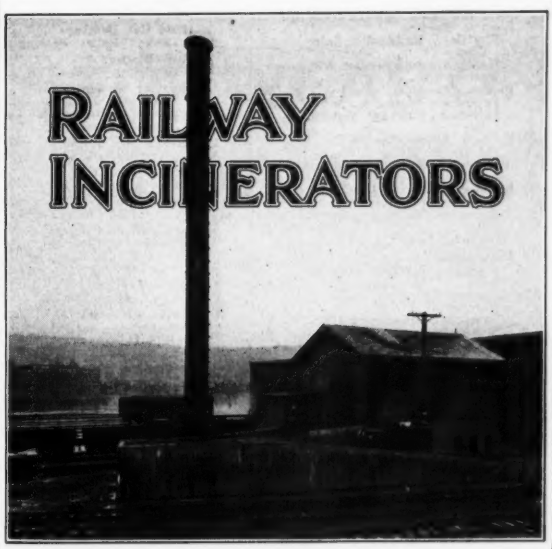

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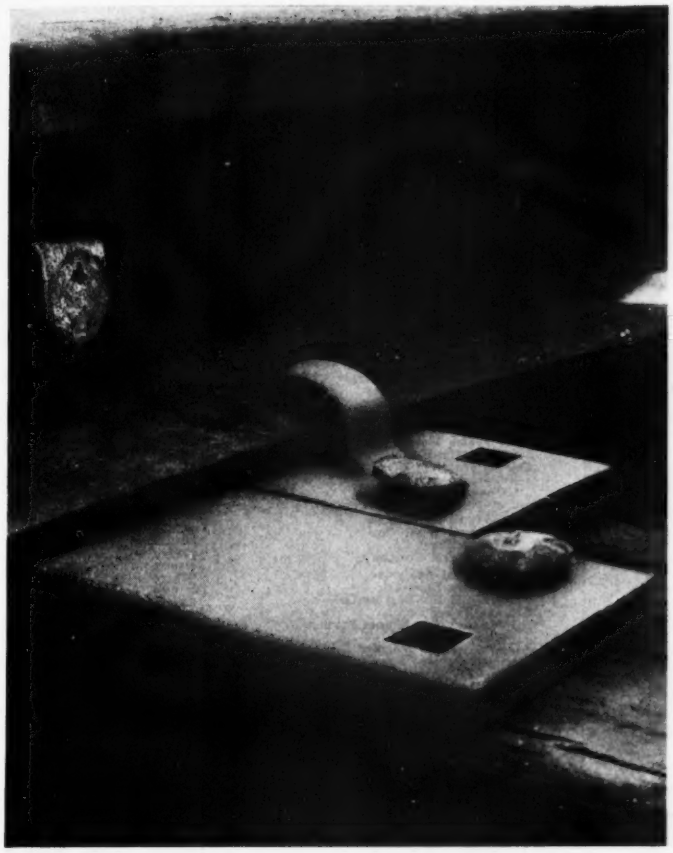

TWIN Frog Plates

fit any angle of the frog

Bethlehem Twin Frog Plates are made of rolled steel and have a forged steel hook that fits over the base flange of the frog, holding it down on the plate and in position. The forged hook is larger and heavier than a track spike and has greater strength and holding power. The bases of the frog plates are flat, providing a uniform bearing on the tie and maximum protection against mechanical injury or wear. Twin Frog Plates are furnished in standard lengths of 23 in., 26 in., and 28 in. They fit any size of frog, and are interchangeable.

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General Offices: BETHLEHEM, PA.

District Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Cleveland, Detroit, Cincinnati, Chicago, St. Louis.

Pacific Coast Distributor: Pacific Coast Steel Corporation, San Francisco, Los Angeles, Portland, Seattle, Honolulu.

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BETHLEHEM

STOP WEAR ON SWITCH POINTS

IN busy yards and terminals the life of switch points is greatly prolonged by the use of Mexican Graphite Curve Grease. This perfect lubricant stops unnecessary wear immediately—cars are switched smoothly—silently—and efficiently.

A small amount of inexpensive Mexican Graphite Grease will protect tons of costly steel.

A sample will be sent on request.

THE UNITED STATES GRAPHITE COMPANY

Saginaw, Michigan

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Mexican Graphite Curve Grease

SAVES RAILS - REDUCES FLANGE WEAR

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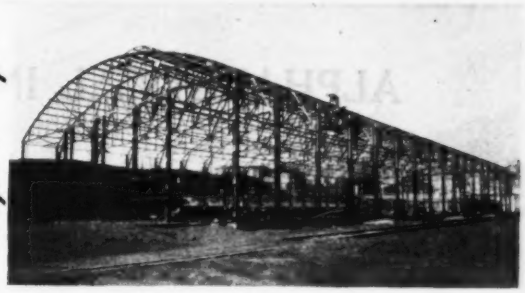
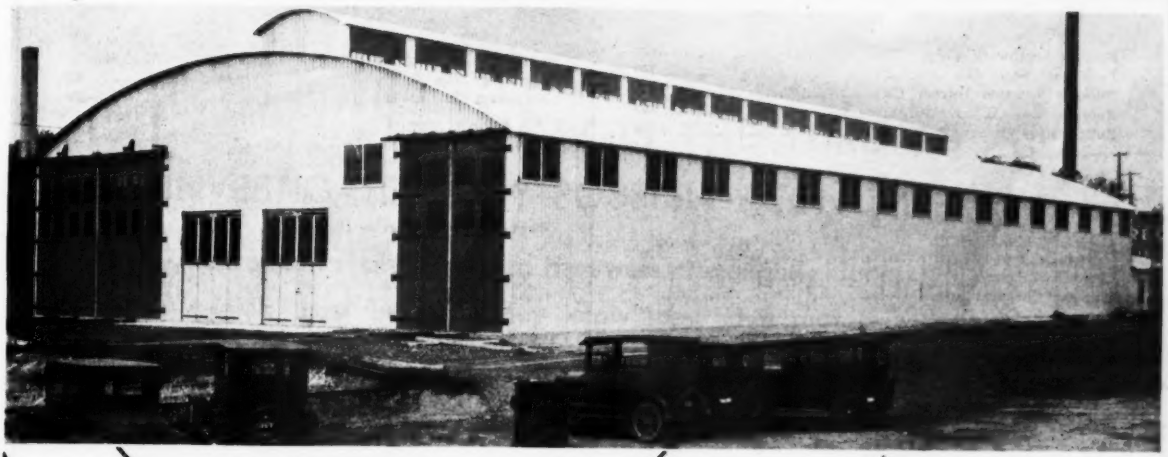
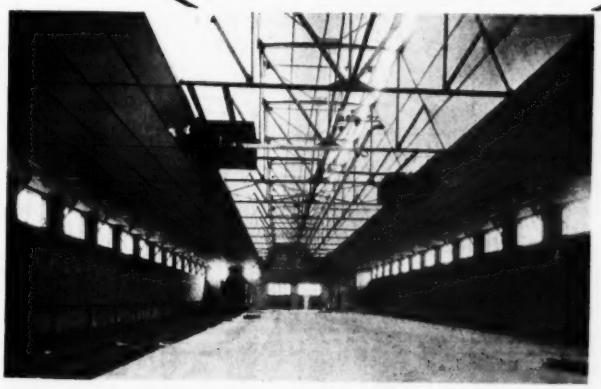
MADE ENTIRELY OF STEEL

BUTLER





READY-MADE STEEL BUILDINGS



At the top right is a photograph of the structural steel frame which carries the C. B. & Q. Fruit House. Its members are designed to give the greatest strength per pound of steel and fabricated in units such as to facilitate quick assembly. The large photograph shows the finished building with the panel corrugated wall and roof sections bolted into a finished exterior. The special Butler panel corrugation multiplies sheet steel strength fourfold over ordinary corrugating. The interior view above the inside insulation is accomplished with Nu-wood a commercial wall board. Insulation and heating facilities are such as to maintain a 50 degree temperature in coldest weather.

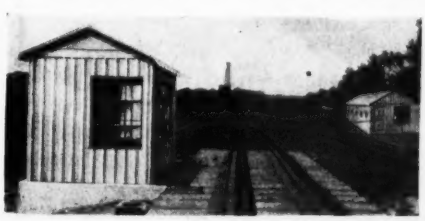
C. B. & Q.
FRUIT HOUSE
MINNEAPOLIS

Perishable cargoes such as fruit necessitate special railway handling facilities in the north country where the weather really gets cold.

The Chicago, Burlington and Quincy Railway has economically solved the problem of unloading and handling car load fruit at Minneapolis with the large Butler Ready-made steel building pictured here.

With a span of 90 feet, a height of 22 feet and a length of 200 feet, it shelters four freight car tracks—two on each side of a double drive truck loading platform. Track doors are 21 feet high, one of them 16 feet, the other 29 feet wide. Two 12 x 14 foot truck doors are in each end giving a double truck drive through the building.

The monitor atop the round steel roof is 16 feet wide, 5 feet high and 156 feet long. 105 stationary and 66 large ventilating type steel window sash, each with 9 lights, daylight the interior. Attached to the rear of the main building is a 24 x 24 foot boiler house sheltering the heating equipment. Approximately 150 tons of steel were utilized in the manufacture of this mammoth fruit house. By way of contrast a small scale house is pictured below at the left. The adaptability of Butler Ready-made, standardized unit design has a full range between these two extremes in railway structures. Butler engineering service will supply you with full details and prices on any size and type of building now under consideration, be they scale houses, track car houses, material depots, freight depots, car repair shops, material treating plants, machine shops, truck and bus garages, signalmen shelters, transformer houses, power houses, et cetera. Railway construction and railway maintenance departments both Save With Steel in Butler Ready-made, standardized unit design structures. We shall be glad to demonstrate with our proposals.



BUTLER MANUFACTURING COMPANY

1247 Eastern Ave. KANSAS CITY, MO.

MINNEAPOLIS, MINN. 947 Sixth Ave., S. E.

Send complete information on Butler Ready-made Steel Buildings, particularly a building approximately ..... ft. by ..... ft., to be used for .....

Firm Name .....

Address .....

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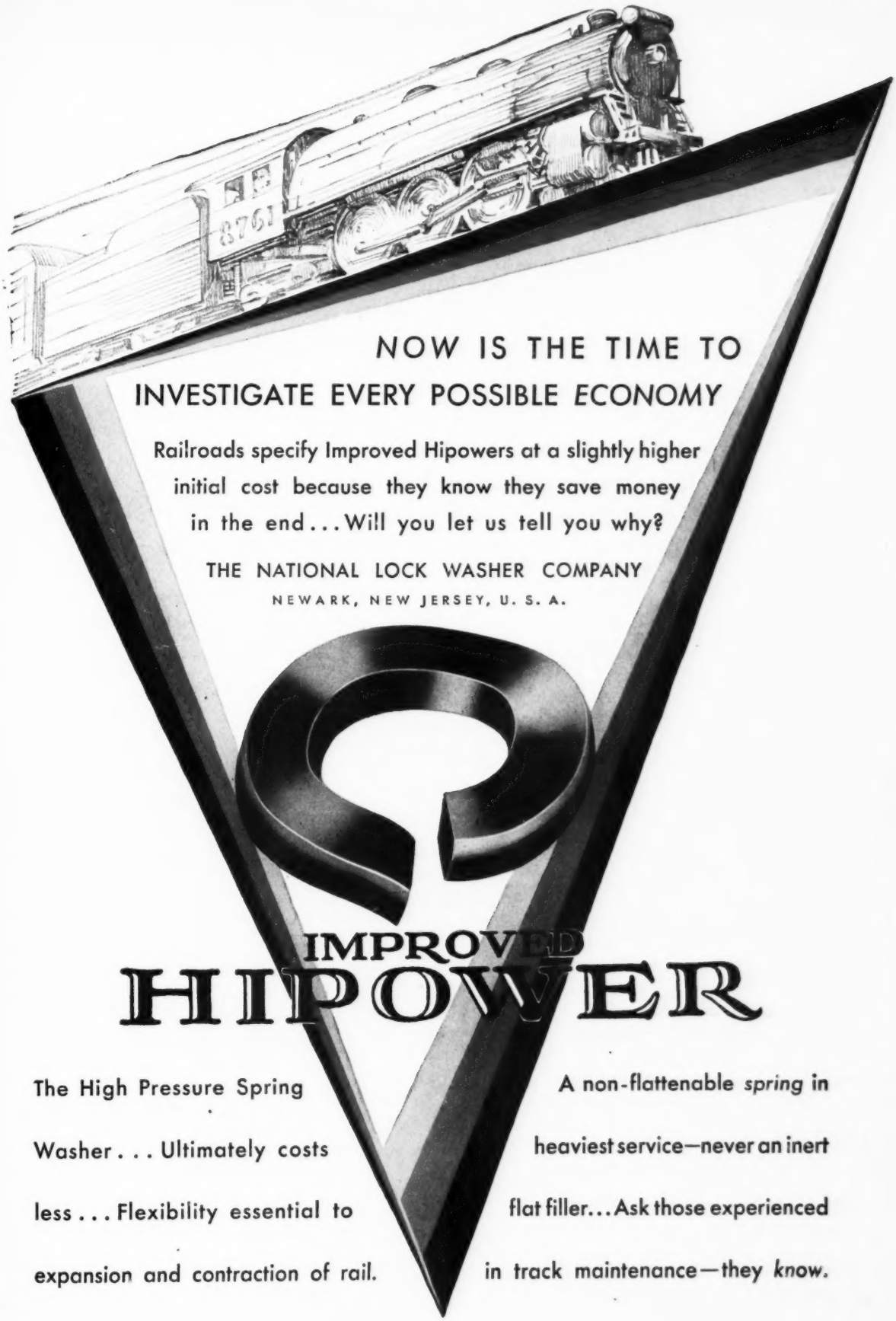
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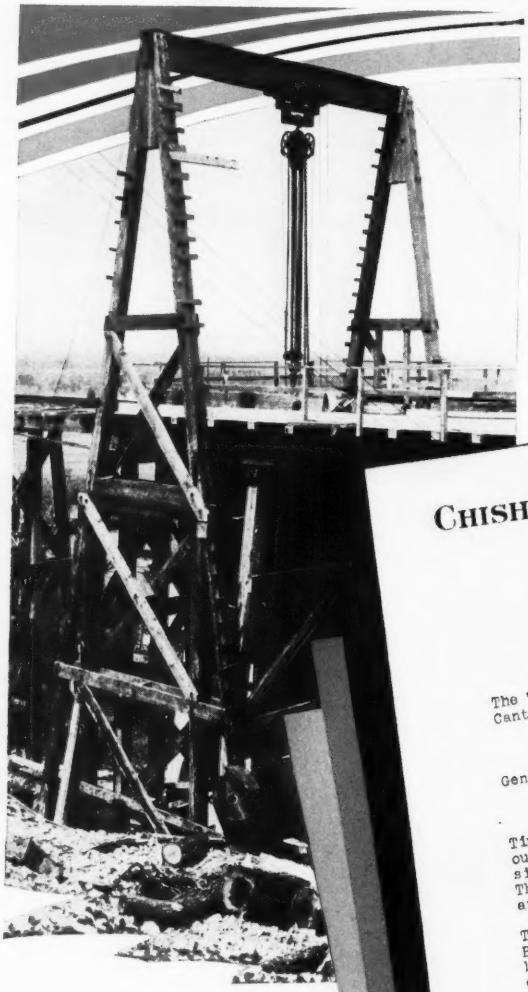
INVESTIGATE EVERY POSSIBLE ECONOMY
Railroads specify Improved Hipowers at a slightly higher initial cost because they know they save money in the end... Will you let us tell you why?
THE NATIONAL LOCK WASHER COMPANY
NEWARK, NEW JERSEY, U. S. A.
IMPROVED
HIPOWER
The High Pressure Spring Washer... Ultimately costs less... Flexibility essential to expansion and contraction of rail.
A non-flattenable spring in heaviest service—never an inert flat filler... Ask those experienced in track maintenance—they know.

" This type of bearing we found to be most suitable for our application as it absorbs all radial loads and end thrust "



30 ton Timken-equipped Chisholm-Moore Cyclone Hoist and Matchless Tandem Trolley installation used to install huge stone crusher. The largest piece handled weighed 32 tons.

Tapered Roller
TIMKEN BEARING
EQUIPPED

CHISHOLM-MOORE HOIST CORPORATION
(DIVISION OF COLUMBUS McKINNON CHAIN CORPORATION)
TONAWANDA, NEW YORK

October 24, 1930.

The Timken Roller Bearing Co.,
Canton, Ohio.

Gentlemen:

Timken Tapered Roller Bearings were adopted as standard on our Matchless Trolleys and C-M Underhung Cranes after considerable experimenting with different types of bearings. This type of bearing we found to be most suitable for our application, as it absorbs all radial loads and end thrust.

The general opinion seems to be that Timken Tapered Roller Bearings have enabled us to furnish equipment which has very high efficiency, permitting smooth operation with minimum effort. There is also durability which insures long life and fewer replacement parts. This means uninterrupted service. Another important feature is that Timken Bearings require very little attention, and maintenance therefore, is kept to a minimum.

We have been using Timken Tapered Roller Bearings for approximately ten years, and have found them most satisfactory in every way.

Very truly yours,
CHISHOLM-MOORE HOIST CORP.
F. W. Shaw
F. W. Shaw,
Sales Manager.

FWS:W

TIMKEN Tapered Roller BEARINGS

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S